DOCUMENT RESUME

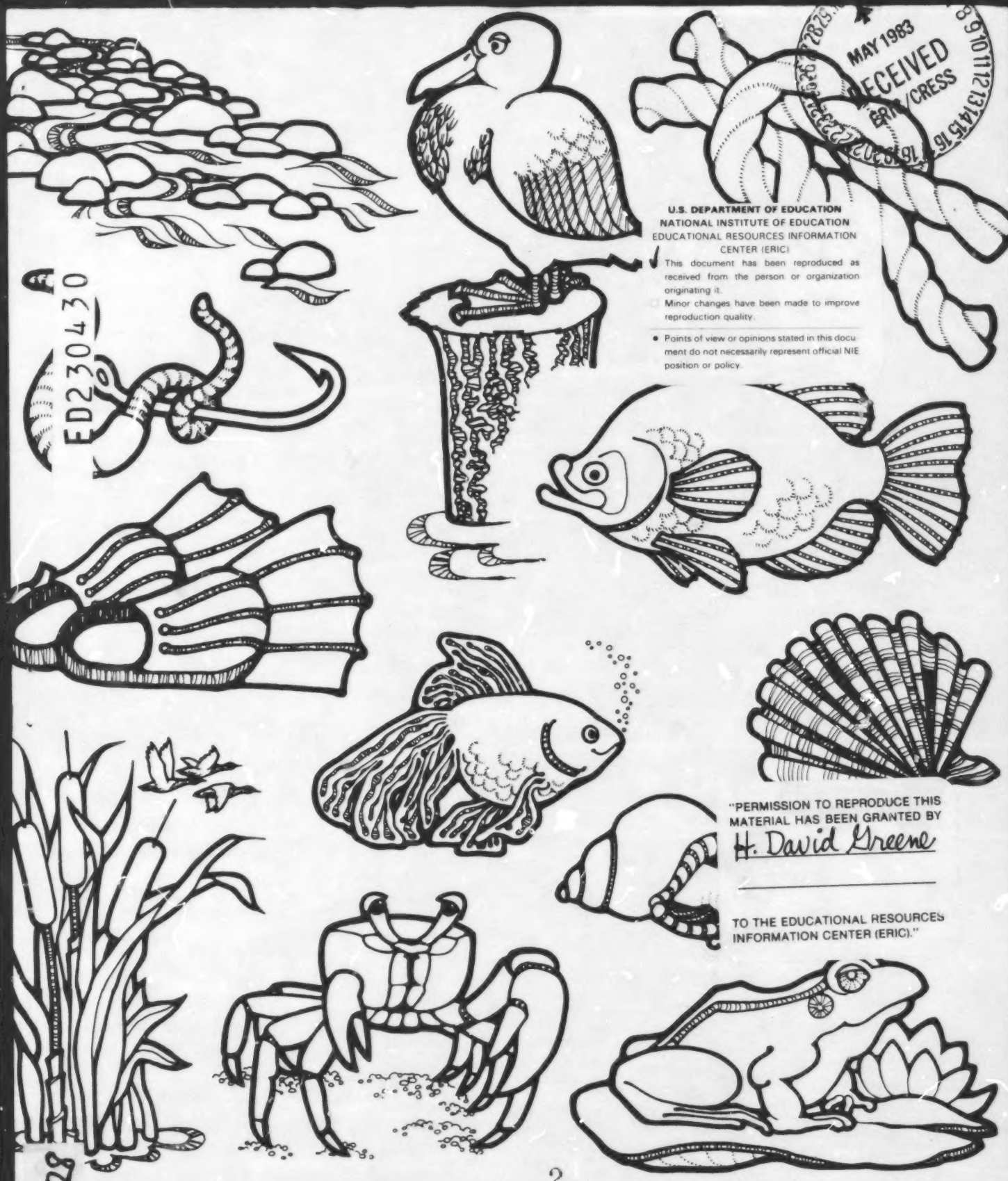
ED 230 430 SE 041 928

AUTHOR	Greene, H. David; And Others
TITLE	Aquatic Activities for Youth.
INSTITUTION	New York Sea Grant Inst., Albany, N.Y.
PUB DATE	May 80
NOTE	44p.; Prepared by the Youth Coastal Education Program and the Marine Education Program.
AVAILABLE FROM	Youth Coastal Education Program, 21 South Grove St., East Aurora, NY 14052 ($2.50).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Animals; Dietetics; Elementary School Science; Elementary Secondary Education; *Entomology; Environmental Education; *Ichthyology; Interdisciplinary Approach; *Learning Activities; *Science Activities; Science Education; Secondary School Science; Simulation; Water; *Water Resources
IDENTIFIERS	*Aquariums; *Marine Education; Recipes (Food); Ropes

ABSTRACT

Designed to meet the diverse educational needs of youth groups, this aquatic program consists of eight individual lesson units, each devoted to one aspect of the aquatic world. Unit topics include: fish aquariums; raising earthworms; simulation of coastal planning; entomology and water; rope; calculating stream flow; saltwater aquariums; and fish in the diet (providing fish recipes and information on buying/storing fish). Activities in each unit may be done by special interest clubs, school clubs, or in school science classes. In addition, the activities can be used for year-long projects. A short leader's guide is also provided. The guide lists names and types of organizations that may help in developing the program and suggests additional activities to supplement those in the eight units. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****



MAY 1983
RECEIVED
ERIC/CRESS

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

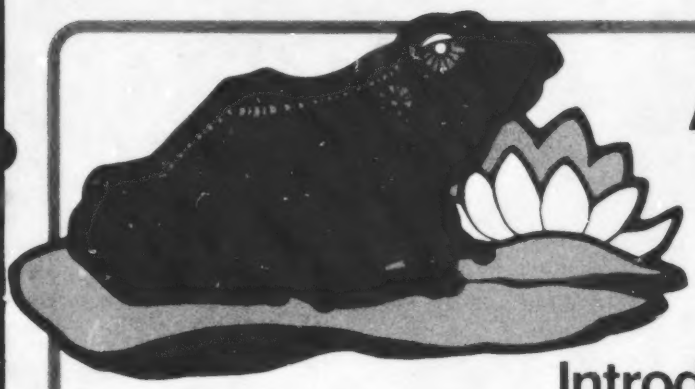
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
H. David Greene
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED230430

SE041928

New York Sea Grant
Marine Education Program



Aquatic Activities for Youth

Introductory Leader's Guide

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Aquatic science is the study of the oceans, lakes, and related environments. As our population grows, the seas become increasingly important as a source of raw materials, food, fresh water, power, and recreation. The necessity of water to mankind, the influence of the sea on people living in coastal areas, and a growing interest in aquatic science have prompted the writing of these educational materials. Designed to meet the diverse educational needs of youth groups, this aquatic program consists of individual lesson units, each devoted to one aspect of our world of water. The units need not be used in a specific order, nor any set number completed. The activities can be used for year-long projects.

These aquatic activities are designed to serve as the basis for meetings in which young people and their leaders explore various aspects of the world of water. The activities can be done by special interest clubs, school clubs, or in school science lessons.

Where to go for help

Draw upon local resources in developing your program. The more members of the community involved with your activities, the better your program will be. Finding a volunteer leader willing to meet regularly with a club is often difficult. It may be easier to get someone with special interests or talents to help with a specific activity. Plan your meetings far enough in advance to give those participating time to prepare. Planning time is particularly important for community people who must be away from their business to participate. Remember, volunteer leaders are there to help you, so hold club meetings at their convenience. The following list suggests names and types of organizations that may help. For local addresses, consult the telephone directory listings as follows.

Listed under New York State:
- Department of Environmental Conservation
- Department of Parks and Recreation

Listed under county heading:
- Soil and Water Conservation District
- Coastal land use planners

Listed under Cooperative Extension:
- Sea Grant Extension Program
- 4-H Division
- Agricultural Division
- Home Economics

Listed under clubs:
- Fish and wildlife clubs
- Sportfishing groups
- Scuba clubs
- Yacht clubs
- Environmental clubs

Listed under fish:
- Fish processing plants
- Commercial fish outlets

For environmental science programs, see:
- School districts
- Universities and colleges
- Museums and aquariums

Listed under youth organizations:
- Scouts
- Boys and Girls Clubs
- YMCA and YWCA
- Other youth organizations

A word about safety

Some activities require that the learner be near water. Make sure each acitivity is well supervised and that participants always work in pairs. Realize that during cold weather, damp footwear and damp clothes are health hazards as well as hindrances to enjoyable learning experiences. If wading in streams is planned, urge everyone to wear boots or old tennis shoes to prevent cuts from sharp objects. Whatever the activity, use common sense and anticipate problems.

Additional activity suggestions

Many 4-H projects can be used to supplement the materials presented in this folder. Contact your local 4-H office for information on these programs:

Let's Explore series

Environmental Awareness (See the sections on marine and aquatic science and their suggestions for activities)

Nature Trails (Trails can be set up in water areas)

Let's Go Fishing

Basic Fly Tying

Bird study materials (Studies can be made of shore and migratory birds and their relationship to water)

Trapping materials

Youth Action to Improve the Environment

Entomology projects (Insects spend their immature lives in and around water)

The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as state and federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6:08

Fish Aquariums

Aquatic Activities for Youth — 1

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Establishing an aquarium can be an educational, interesting step into a new world. Fish are beautiful creatures, and with proper planning, they can be inexpensive, easy, and soothing to work with. Without planning, they can be messy, expensive, and anything but soothing. If your aquarium is set up properly, you won't need to do much to operate it efficiently. Your fish will be dependent on you, and you will have to feed them and keep their tank clean. Your project will show your work, careful or careless. It will give you the chance to observe actions and behavior. Your tank will become a fascinating showcase, beautiful and scientifically balanced.

You will find yourself asking many questions about these interesting creatures. Most of your answers will come from nearby sources. Here are some examples:

- Talk to friends and other people who have fish. They may be able to give you ideas from their own experience.
- The pet store where you bought your fish and equipment should have helpful information.
- In section 597.074 of your public library, you will find books on aquariums and fish. Librarians will also help you find what you need. Keep a list of the most useful books (title, author, publisher, and date) to study later or to help others start their projects.
- Look up magazines on aquarium science in the library.
- Some towns have aquarium clubs or societies you may want to join.

Project activities are divided by equipment and experience. You may use any you wish, but you should consider your experience and the time you have to work.

Outline of Projects

Part 1. The Balanced Aquarium

Equipment

- Simple bowl (beginner)
- Specialized tank (advanced)

Environment

- Plants, rocks, sand, water, and filters

Foods. For a successful aquarium more care is needed than just dumping food in each day.

The fish

- Selection
- Identification and classification

Part 2. Breeding

Types of fish

Traits

Diseases, pests, and problems

Part 3. Specialized aquariums (salt, fresh water, and specific habitats)

Keep a record book of whatever you do. Record costs, trials, and tribulations. Observe what goes on; then make some observations. These observations should lead to more questions. Learn to rely on another person or a good reference book when your own experience fails you.

Part 1. The Balanced Aquarium

Equipment

Let's think about the "home" you are preparing for your fish. Let the water in the tank "season" one or two days before putting the fish in. This time allows dissolved chemicals (chlorine and sulfur) to settle in the water, bacteria to break down detergents, plants to establish roots, and rock dust to settle and leave the water sparkling clean.

Here is a list of things you'll need for your fish-in-a-bowl project:

salt (noniodized)	gravel
nylon net or cover	plants
siphon	snails
thermometer	food
net	

For an aquarium, you'll also need to purchase a light, pump, and filter. Bulky items that need to be stored can be divided among your friends who have fish.

The size of your water container controls the number of fish you may keep in two ways: it limits the amount of water, and it limits the surface area. Fish need oxygen just as people do, but their oxygen comes from water, not air. Putting too many fish in a tank is like putting too many people in a room. Too little surface area is like shutting all the doors and windows tight.

If you are using a bowl, fill it to the widest point, and allow at least 2 inches above the water line to keep fish from jumping out.

If you are using a large tank, fill it to within 3 inches of the top. The 3 inches allow for 2 inches of space at the top and 1 inch of gravel on the bottom. Here are some examples of how many fish your aquarium might hold. A gallon-size jar holds six to eight neon tetras, which are a small, slender fish. Two pairs of fish that altogether measure 1 inch in length require a gallon of water. More fish will require the aid of a pump and filter. A 5-gallon tank holds six pairs of fish, plants, and other animals. Labyrinth fishes, which swallow air from the surface, can take more crowding. But male Siamese fighting fish are always kept alone in quart jars since they kill one another if they are in the same container. It is best to allow fish plenty of elbow room until you have gained experience. Remember, fish grow and multiply.

To sterilize your tank and check for leaks, first wash the bowl and any accessories such as castles or marbles. Put the accessories into the bowl and fill it to the top with hot water. Add as much salt as will dissolve. Let the water set for about 1 hour. If you have a tank, dip or siphon off the water to prevent springing the sides. Rinse and add clean seasoned water, and you are ready to set up for your fish.

A small bag of colored gravel will cover the bottom of two to six 1-gallon jars. Solid-colored gravel is better than multi-colored because you can spot dirt and uneaten food more easily. Use care in selecting rocks for the bottom of your tank. Many rocks are limestone and will make the water alkaline. Some blue and green rocks contain poisonous compounds. Marbles are safer. Be sure that any decorations are colorfast and insoluble.

Net. Sometimes people handle fish with their hands, but the hands must be wet before handling the fish. It is best not to handle fish with your hands. Buy or make a small net.

Cover. A nylon net cover will keep hands, cats' paws, and foreign objects out. A half-yard will do for several people. A wad of extra net makes a fine cleaning cloth, and a narrow piece can be pulled through dirty tubing with a piece of fine wire.

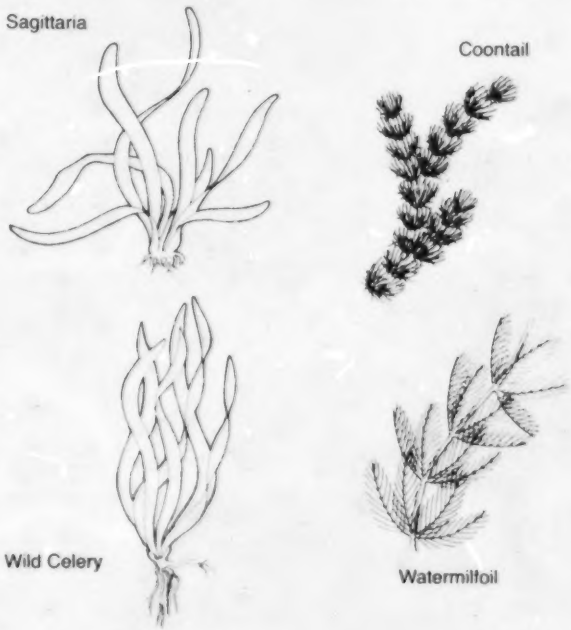
A box of plain, noniodized table salt is good for cleaning your equipment. **Never use detergent!** It can harm fish. Salt sprinkled on a clean cloth or wad of nylon net does an excellent job. Sick fish will sometimes recover in a solution of 2 quarts of seasoned water with 1 teaspoon of plain salt added. Put them in this solution for one-half hour each day until they seem better. To get rid of food particles and algae growth, rinse plants in the same solution when you clean the tank. Finish by rinsing them in clear tap water.

Thermometer. An indoor or outdoor thermometer will let you check water temperature when you change or add water. You may want to get a small aquarium thermometer to keep a constant check.

Environment

Depending upon the kinds of fishes you raise, the temperature of the water can be critical. Sudden temperature fluctuations may easily harm or kill your fish. If you are raising tropical fish, the temperature should be kept between 70° and 85°F., the optimum temperature being about 75°. Don't put tropical fish in water below 75°F. Careful monitoring of temperature is not as important for goldfish. They may live in water from 50°–75°F.

Plants. Plants increase the available oxygen in the water. Choose healthy plants with good color, a clean odor, and no slime. Rooted plants will need 1 to 2 inches of gravel. Slant the gravel so it is deepest at the back, and the dirt will collect at the front where it is easily removed. Plants can then be placed where gravel is deepest, to provide a background. Do not crowd plants because they take up space and get food caught on their leaves. If plants are placed on the side with the most light, baby livebearers will swim into them for protection. A small bunch of floating water plants will be enough for two to four bowls. Although several plants can be used, the hardiest are *Anacharis*, *Cabomba*, and *Vallisneria*.



Siphon. Plastic tubing for a simple siphon can be quite inexpensive if you buy plastic rope; if you want a suction attachment, it will cost more. Siphon up to one-third of the water from the bottom of the tank once a week. If you replace it with seasoned water, you will not have to change the whole tank unless you overfeed. For the tubing to work, it must be full of water. Fill it at the sink or by slowly lowering it into the tank. The end from which the old water exits must be lower than the intake end, which must be under water at all times. To move the siphon, pinch the tubing by folding it sharply.

If the siphon is working properly, dirt will be quickly sucked into the tube. Extend your finger below the intake end to guide the tube and stir up the dirt, especially if your gravel is fine enough to be picked up. Keep the tube slightly above the bottom. If gravel or a snail is pulled into the end, it will often drop free if the tubing is pinched. If it gets into the tubing and stops the flow, you may be able to flush it out by raising the intake end or by using the faucet. If this does not work, hold one end of the tube with one hand, and squeeze the rock or snail out of the tube with the other hand.

Snails. Snails can be large or small and are relatively inexpensive. You may find some on the plants you buy. Snails are helpful because they eat the food the fish leave and remove algae that forms on the sides of the tank. Baby snails look and feel like a fine grain of sand but grow quickly. They will be a nuisance unless you control the number in your aquarium. Snail eggs should be allowed only in large tanks. For large tanks, large snails are good because they do not eat plants and do not reproduce rapidly.

Use two small snails per gallon of water. Have no more than three large snails in a 5-gallon tank.

How to Fill Your Tank (one method)

1. Assemble the materials one or two days before getting the fish.
2. Put gravel in a pan or large strainer, and run tap water over it until the water runs clear. All gravels have some dust. Even after the gravel has been washed, dust may cloud the water until it settles.
3. Place the gravel in the bottom of the tank. Put more gravel in the back than in the front. This will bring dirt to the front for siphoning and allow deeper gravel for background planting. In round bowls with floating plants, the gravel should cover the bottom evenly.
4. When filling the tank, put a piece of paper or a saucer on the bottom of the tank, and pour the water onto it. This technique will lessen the disturbance of the gravel. Fill the tank one-third to one-half full.
5. Add plants and accessories. Fill the tank to within 2 or 3 inches of the top.

How to Fill Your Tank (an alternate method)

Follow instructions 1 and 2 above.

3. Fill the tank one-third to one-half full of water. Put the gravel in a cup or jar. Holding the cup under water, pour the gravel slowly into place in the tank, and shape it with your fingers.
4. Add plants and accessories.
5. To complete the filling, place your hand in the tank so your fingers touch its side and your palm is facing toward you. Pour the water onto the palm of your hand so that it runs down your fingers and onto the walls of the tank without disturbing the gravel.

Locating the aquarium. Put your aquarium in a place where it receives a moderate amount of light. Strong light encourages the growth of algae, which turns the water green. In general, a northern exposure of light is most suitable, although a western exposure is also good. If it is necessary for the tank to face the sun (southern window), fasten a sheet of green cellophane to the portion closest to the window.

If algae turns the water green, you may add quantities of Daphnia, or waterfleas. After the water is cleared, the fish will feed upon the Daphnia. If there are several fish in the tank, you may wish to put some in another tank so the Daphnia won't be eaten before they can clean out the algae.

If sufficient light is not available and plants begin to lose their green color, place an electric lamp with a 75- or 100-watt bulb over the aquarium a few hours a day. Do not keep an aquarium close to a radiator.

Activity: Balanced Aquarium

Program: To set up a nearly balanced tank of fish and plants. (A balanced aquarium is often stated as a desired goal; however, no such thing exists.)

Exhibit: Two fish of different species and a picture of your tank.

Beginner: At least one pair of fish with a simple, appropriate environment (two fish if you are unable to sex them). If you are using guppies, you will need three fish (two females and one male.)

Advanced: Above suggestions with a planned program, definite goals, and a statement of results.

Food

Many varieties of food are available. Carefully look them over, and ask the advice of the clerk when you buy your fish. Some fishes are surface feeders, some eat only from the bottom, some prefer sinking pieces, and others don't care. Perhaps you and your friends would like to buy several kinds and share them. A small packet of food goes a long way. By sharing you can have a variety of food without spending much. Feed goldfish once a day. Tropical fish can be fed two to four times a day. You may feed them up to every 2 hours if you want quick growth, but you *must* keep the feedings small. Be sure they clean up every bit in 5 minutes. Overfeeding is easy and dangerous.

Since goldfish do best in cold, nonheated water, they should not be placed with tropical fish. Most tropical fish require warm, heated water.

Activity: Feeding Experiment (one month)

Use two groups of fish. One group of fish could be fed live food. The second group could be fed regular dried types of food. **Important:** Avoid feeding experiments that deprive the fish of food or that deliberately mistreat the fish. Your fish are living animals.

Activity: Raising Live Food (one month)

Program: To raise live food.

Exhibit: Fish fed on live food and samples of live food.

Choosing Your Fish

If you have an unheated and unaerated bowl, you will have to use care in choosing the variety of fish for your project. Many fishes will do well in this environment, but some will not adapt to the lower temperatures, and others are particularly hard to care for. Remember, the water temperature will be a few degrees lower than the temperature of your home, and if the tank is in a draft, the water temperature will be even cooler. Tanks that are covered and electrically lighted will be several degrees warmer than the room. Water temperature changes more slowly than that of the air. Guppies, which do best at 74–84°F., will survive in 68° water, but they will not breed.

Kinds of fish

Barbs and similar fish:

Cherry Barb, Checker Barb†, Gold Bar*, Pear Danio†, Zebra Danio†, Goldfish†, White Cloud Mountain† (the last two prefer from below 64°–74°F).

Tetras

Neon*, Cardinal, Red-eyed, Black-lined, Buenos Aires†, Tetra† from Rio, similar fish is a Bloodfin†

Livebearers (can be sexed by anal fin-gonopodium — where the anal fin of the male is modified to transfer sperm)

Guppy*, Molly*, Swordtail*, Platy*

Labyrinth Fishes (take extra air at surface)

Betta or Siamese Fighting Fish (keep male in individual bowl), Three-spotted Gourami*†, Blue Gourami†, Opaline Gourami†, Dwarf Gourami

Assorted Families

Peppered Corydoras* (catfish), Egyptian Mouthbreeder, Glass Fish, Australian Rainbow Fish†

Activity: Exhibit

Beginners. Complete record page; identify fish (number, species, sex; food and care record; anatomy picture and type of family if needed). Exhibit a specimen or pair that you have had for at least 4 weeks.

Advanced. Complete record. Keep notebook with program plans, records, and results. Choose and exhibit fish appropriate to program.

Fish Disease. Fungi such as water mold (Saprolegnia) and a protozoan called water itch are two of many parasites that bother fish. Fish with these conditions may show gray patches or scales on their fins and should be isolated quickly. So little is known about many fish diseases that it is usually best to destroy the diseased fish.

You may try immersing the diseased fish in a 10 percent solution of noniodized salt. Remove it after 1 hour and allow it to swim in ordinary water. Usually the patches disappear after this treatment. Put the fish into a 0.5 percent solution of potassium permanganate for 15 minutes. Quarantine the fish in a separate tank, and watch it for a possible recurrence of the condition.

Other symptoms of disease are discovered by watching the behavior of the fish. Watch for the following activities:

- Hiding in the plants,
- Lying on the bottom,
- Holding fins close to their body,
- Gasping for air at the top.

*Fish cared for in a one-gallon bowl.
†Fish that tolerate temperatures as low as 64°F.

Part 2. Examples of Advanced Programs in Breeding

Simple Breeding (3 months)

Program: To start breeding records
Exhibit: Parents and selected young fish

Advanced Breeding (A year or more)

Program: To breed for a specific trait (color or conformation)
Exhibit: Selected young fish

Fish Care Habits

Bowl check. Each time I look, I automatically check—

- Are all fish alive and healthy? Any torn fins?
- Any uneaten food on top or bottom?
- Equipment working properly?
- Temperature? Out of drafts and protected from full midday sunlight?
- Plants healthy and in place?
- Water level up, clear, no foul smell?
- Tank covered? no foreign objects?

General management

- Isolate new or sick fish in a separate small bowl.
- Keep everything but objects known to be safe out of water.
- Turn light off at night and on in the morning (constant light makes fish infertile and may cause algae problems).
- Do not tease fish by splashing water or tapping on the glass. However, goldfish may be trained to come to the side of the bowl by tapping softly.
- See that family members understand the safety rules.

Feeding

- Feed regularly: goldfish once a day, tropicals two times or more if you can.
- Feed no more than they can eat in 5 minutes; remove food promptly.
- Feed fish yourself. In emergency, leave written instructions or have another hobby member do the feeding.
- Give a variety of food.
- Keep food out of reach of others.

Cleaning

- Wash hands before and after caring for fish. Rinse thoroughly before.
- Dump waste water in toilet, *not* in sink.
- Rinse any dishes or pans carefully before using. Don't use metal.
- Wash any dishes or pans thoroughly and put away after use.
- Condition water by aging or with chemicals (well water does not need conditioning).
- Clean the bottom of the tank by siphoning about one-third of the water once a week.
- Replace siphoned and evaporated water with conditioned water.

- Check water temperature before adding it to the tank. Warm the water if necessary by heating a small amount. Add the water by pouring against your palm and down your fingers onto the side of the bowl.
- When changing the water in the entire bowl, save the top one-third to one-half of water if possible to place fish in and add it to the new water later.
- When changing the water in the entire bowl (fish out), use salt (not soap) to clean the bowl.
- Scrape the water evaporation mark off the bowl regularly to prevent an accumulation.
- Use a scrap of nylon net to clean the sides of the bowl.
- Keep all chemicals on a high shelf. They will kill fish if they are not used according to the instructions on the container.
- Never touch fish with your hands; use a net.

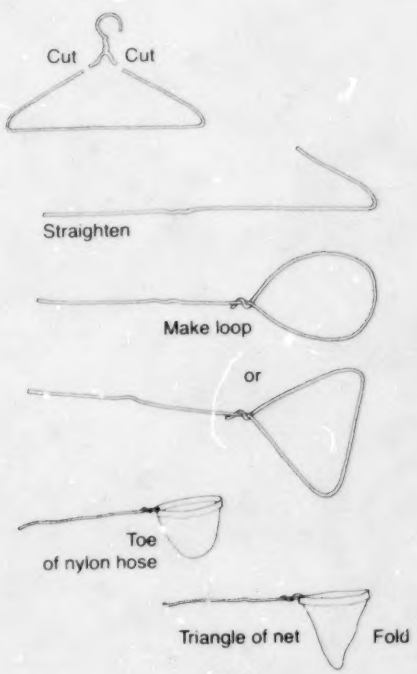
Safety Rules (For your family and friends)

Fish need specific kinds of care. Do not leave small children alone with fish until you have supervised their first viewings and have carefully explained that they should not try to care for or play with the fish. Anyone who does not know how to care for fish should not:

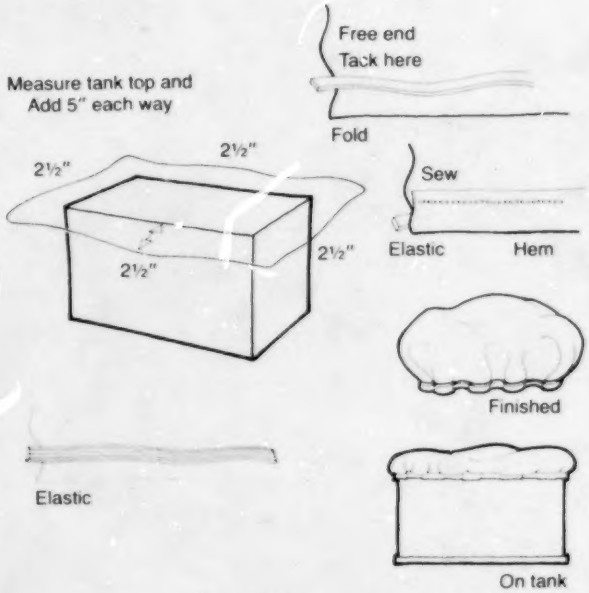
- put anything in the water,
- feed fish,
- tap on the glass or splash the water,
- touch the equipment, or
- try to catch fish.

Simple Equipment to Make Yourself

Net. Wire clothes hanger, ladies nylon stockings (without holes or a run in the toe), tape or file, needle and thread, pliers with wire cutter or both pliers and wire cutter. Cut hanger as shown. Straighten. Bend short end into loop and twist around handle. Smooth rough edges with file or cover with tape. Cut about 3½ inches from toe of hose, and sew onto loop of wire. You could instead use a small piece of nylon net.



Tank cover. Piece of nylon net, narrow elastic, needle, and thread. Cut nylon net 5 inches wider and 5 inches longer than tank measurements. Cut elastic long enough to reach around tank. Leaving 1 inch of elastic free, tack it firmly to net, fold net over elastic, and sew a casing for it. Pull end of elastic forward as you sew, gathering net. Elastic must pull freely through casing except where one end is tacked. When you have sewn around all four edges of net, overlap the end of the elastic (1 inch free at beginning), and sew it firmly.



Bowl cover. For round top you may use a square of net and secure it with a large rubber band.

Siphon. For small jobs, use two large plastic straws and masking or freezer tape. Pinch end of first straw slightly to insert into second straw. Tape securely to make airtight. Dampen finger and place over upper end while lowering straw into water. Remove finger and replace immediately. This sucks any dirt just below straw into straw. Keep finger firmly over end while removing dirty water to a waste jar. Remove finger to let dirt run into jar.

For large jobs, measure tank from bottom to top; then measure from top of tank to floor, and add about 6 inches. Find or buy a piece of plastic tubing this long. Get a gallon jar to put the dirty water in.

Fish bowls. A single fish may be isolated in a clean, wide-mouth quart jar such as those mayonnaise and peanut butter come in. Cover and keep water level down 2 inches from top. You can make a bowl for many baby fish or up to six small fish. Ask a restaurant or drive-in to save you the kind of 1-gallon jar that pickles, mayonnaise, or mustard comes in. Clean carefully and rinse with salt water; then rinse several times with clear water. Fill jar to about 3 inches from the top, and cover it with a net, never a solid lid.

To transport fish or introduce them to water of a slightly different temperature, use a heavy-gauge plastic bag. Test the bag first to make sure it is watertight. Fill it half full of water and fish (at least a pint of water), and close it with a rubber band. Carry the bag in a large purse, cardboard container, or styrofoam box to protect the fish from chills or overheating and jolts that might rupture the bag. Do not leave the fish in the bag any longer than necessary. To introduce the fish into different water, hang the bag in the new water for at least 15 minutes; then rupture the side of the bag carefully to let the fish swim free.

Preparing Fish for Exhibit

- If you have several fish, choose large, healthy specimens.
- Carry the fish to the show in a small bowl with a plastic cover. Put the bowl in a box and hold it firmly in place by putting foam rubber or tightly wadded paper around it. This will protect it from spilling and minimize temperature changes.
- In certain cases when you cannot exhibit your project fish, you may get permission to buy one and be judged on choice of suitable fish. Examples of acceptable reasons are: (1) livebearer female close to term (guppies are fairly hardy, but mollies often lose their babies if moved); and (2) fish died from cause other than neglect. Get permission of leader and parent. Include explanation with exhibit.

Example: *I am not able to exhibit my project fish because . . .*
I chose the alternate fish for these reasons . . .
(note desirable characteristics)

Name _____

Part III. Specialized Aquariums

Native (Freshwater) Aquarium

One interesting and inexpensive experiment is to set up a native aquarium containing materials and animals from streams and ponds in your own locality.

A small rectangular tank will do. You might even use one of the all-glass, flat-sided aquariums that can be purchased for several dollars in a discount or department store. Even a gallon wide-mouthed jar (although restricted in its uses) will do for a small start.

Put sand in the bottom of the container, and plant whatever you have collected. Don't put fish in for several weeks; wait to see what develops without them. Some interesting things can happen.

The next step will be to put some fish in, preferably from the same source as plants. If they come from a fast-moving stream, you should introduce some aeration. If they are from a small, still pond, aeration may not be necessary.

Keep a careful record of your progress with the project.

Marine (Saltwater) Aquarium

A marine aquarium is a complicated project that is not for the beginner to try. It requires, among other things, a careful control of salinity in the water. For this, a hydrometer is necessary. One must also have a tank in which metal surfaces do not contact the water.

Anyone living near the sea, however, has a chance for maintaining an excellent marine tank. Some of the most beautiful fish are marine inhabitants. The tank must be rather large (5 gallons per fish) and free of corrosive materials. Some cements are dissolved by salt action.

Carefully record your work and results.

Notes for Leaders

The activity sheet on fish aquariums contains all the information needed to carry out this project. The leader should stress observation skills above all else. By observing a fish aquarium, you can see many behavioral displays, food chains, and environmental relationships.

The members' guide is broken down into sections that can be covered in one meeting. But you should judge for yourself if more time is needed to cover the material in each section.

Encourage each member to use record sheets for systematic observations of life in the aquarium.

If further help is needed, section 597.074 of your library has books on aquariums and fish. Local aquarium and pet stores may also be of assistance.

Part I. The Balanced Aquarium

Equipment. Use a loose-leaf notebook to keep records of the equipment used in the project. Whenever possible, have the members describe the equipment and how it is used. Diagrams can be drawn to illustrate special conditions.

Because aquarium equipment is expensive and needs proper care, members could keep a ledger of the purchase and maintenance costs of the equipment. They can also estimate the cost (based on wattage) of energy needed to heat the aquarium and run the pump.

Costs should be recorded for the entire project and broken down for each aquarium.

Environment. Because different fishes require different environments, a record of conditions affecting the fish can be kept. This record might include water condition, depth, temperature, acidity, hardness, or materials used in the aquarium. Plants and their uses can also be observed. A diagram showing the location of plants in the tank can be drawn, and observations of the reaction of the fish to the plants can be made.

Foods. Fish depend on the proper foods to keep healthy. A record can be kept of the kinds of food used and the results obtained from them.

Some fishes eat nothing but dry frozen food. Scraps from the kitchen, worms raised in the basement, or foods gathered from nature can also be used. One meeting might be spent collecting food, such as Daphnia and Tubifex worms from ponds or streams near where you live. But be careful not to introduce anything harmful into the aquarium.

The fish. Have members keep a record of the different kinds of fishes acquired for the aquarium project. Include the common name, scientific name, date introduced, cost, and general comments. Drawings can be done of the fish to note identifying characteristics.

Part II. Breeding

Breeding habits vary greatly from one species to the next, and observations and records can be made to distinguish different breeding patterns. Which fishes bear live young? Which lay eggs on sand, plants, or in the water? Do all species breed in captivity? Record of the care given to fish during breeding can also be made.

Another project that members might undertake is the study of fish behavior. Observe traits such as territoriality and schooling. Why do fish behave in these ways?

Diseases, pests, and problems. Aquatic animals, like all other living things, can be affected by diseases and other threatening conditions. Quick identification and remedy of such problems are important.

Have members record symptoms of illness and steps to correct the problem. Encourage them to be aware of disease and other enemies and careful not to introduce them into the aquariums.

Some fish are going to die. Keep a record of the deaths to prevent future losses.

Experimenting. Because aquariums are fascinating laboratories for studying fish, members can conduct experiments using the following steps:

- Purpose — Tell what you hope to learn.
- Procedures — Describe what you are going to do.
- Observations — What happened as a result of what you did?
- Conclusions — What did you learn because of your observation?

The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

Some ideas and portions of this sheet used by permission or adapted from the 4-H Aquatic Science project, Worcester County, Maryland Extension Service, the University of Maryland cooperating, and *Aquatic Science — Fish Culture* by James T. Davis, extension fisheries specialist, the Texas A&M University System.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

Raising Earthworms

Aquatic Activities for Youth — 2

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Almost every angler began by using worms or natural bait. The garden worm and night crawler are the youngster's old favorites in fishing. This activity, which involves raising, storing, and securing natural bait, goes beyond a trip to the garden to secure worms.

Objectives

- To learn to raise worms for personal use and profit.
- To experience the pleasure of raising natural bait and catching fish with it.
- To accompany the 4-H *Let's Go Fishing* and *Fly Tying* projects.

Raising Earthworms for Bait

An earthworm bed in a basement or backyard can supply worms for fishing whenever needed. Thousands of worms can be raised with little trouble, and sale of them can be interesting and profitable.

Building a Worm Bed

For the beginning grower, an ordinary galvanized work tub or similar water-tight container is excellent for raising worms. The size of the container depends on how many worms will be produced during the year. To prevent rust, metal containers should be painted on the inside with hot roofing asphalt, acid-proof paint, or any good housepaint. A drain hole is needed in the bottom of containers. A 2-inch hole covered with a fine meshed copper or aluminum screen will do. Sealing the screen with tar or paraffin wax allows good drainage and prevents earthworms from leaving.

Worm beds may also be constructed of concrete block, brick, or pine boards laid on the ground or on a concrete slab. Any convenient length is satisfactory, but the width should not exceed 40 inches. The box may be up to 20 inches deep, but the soil depth should not exceed 10 inches.

Location of worm beds should be carefully chosen. The most important considerations are soil temperature and drainage. Worm beds may be located outside in heavily shaded areas or inside in a shed, basement, or garage, if drainage is available. Soil temperature should not exceed 60°F. because worms must be kept cool in the summer. If they are to be kept alive in winter, the soil must not freeze. Outdoor beds present fewer drainage problems than those inside, but they must be protected from the hot sun. If the containers are partially buried, roots may spread into them, and heavy rains can cause soil saturation and the loss of worms. A roof over the bed or a cover over the tub provides protection from rain and sun. A simple board covering can serve this purpose.

Soil

The type of soil used for raising worms is important. Loamy soil is best and can be prepared by mixing manure, screened topsoil, and peat moss. Peat, dead leaves, and straw make fine additives and supply fiber to keep the bed loose and porous. Keep in mind, however, that peat is too acidic to be used alone. Peanut hulls and lawn clippings also may be added to the soil in the bed. The soil should be kept moist, but not wet, by spraying with water. The amount of moisture is correct if the worms remain midway down in the soil.

Stocking the Worms

Once the bed is ready, it can be stocked with 30–50 worms of either the small garden form, which is 2½–3 inches in length, or the larger night crawler. The smaller worm is the one selected by commercial breeders. Commonly called the red worm, it can be purchased from worm-breeding outlets, which can be found in the classified section of outdoor and gardening magazines. Worms for breeding can also be dug up with a potato fork or shovel during a field trip.

Feeding the Worms

Earthworms eat a variety of foods. They eat the soil and extract organic matter to digest. Adding cornmeal mixed with vegetable shortening or lard is also good. Mix 1 pound of cornmeal and ½ pound of vegetable shortening in the first 2 or 3 inches of soil. Kitchen grease will also work, if excess salt is removed by slowly heating the grease with water. After 30 days, or when the worms begin to hatch, dust food over the bed and water it immediately. As the worms grow and feed more rapidly, they eat most of the food within a few days and finally eat holes through the crust it forms. When this happens, feed them again right away. Weekly feedings are needed when the worms are young. Once they start growing, they can be fed once every 2 weeks or as needed. Carefully turn food into the soil with a spading

fork. This loosens the soil and mixes partially decayed soil throughout the bed.

Old leaves, lettuce, celery, and other vegetables can be fed to worms in small amounts. Crushed eggshells and ground garbage are other possibilities. It is important to supply enough protein to feed the worms but not so much as to heat the soil. If you overfeed, the excess protein decays through a chemical reaction that produces heat, and flies are attracted. Worms will be most healthy if protein in the feed is kept between 9 and 15 percent.

Worm Bed Management

The worms deposit small brown cases about ⅛ inch in diameter, which contain three to ten eggs. Young worms hatch in about a month and may be seen feeding in the beds. If the eggs fail to hatch, the beds may be too acidic. To correct this problem, compost should be added.

If worms become too crowded, they will not grow rapidly. Small worms should then be transferred to another bed.

Harvesting the Worms

Worms will be ready to use for fishing in about 60 to 90 days; and in 6 months, the soil will be saturated with earthworms of all sizes. It will be possible to select whatever size is needed for a particular fishing expedition or for sale.

To remove worms from the tub, take some of the soil containing worms and place it loosely into a 10-quart bucket. After about 30 minutes, remove the top soil from the bucket and place it back into the bed. Most worms will be found in the bottom 5 inches of the bucket. Morning is the best time to remove the worms from the bed because they will be near the surface after feeding the previous night.

Control of Parasites

In addition to the worms, several other animals enjoy the food and soil in the bed. These include mites, ants, rats, and mice.

The earthworm mite becomes a problem for most worm producers. Unless growing conditions are ideal, these small gray or brownish pests can cover the top of the bed in a short time. They do not attack healthy worms but eat the feed and make it necessary to feed worms more often. The standard recommendation is to use sulphur dust, often sold as "flowers of sulfur," on the tops of the beds. Light application is sufficient and will not injure worms. Repeated application results in acidic soil. In this case, a new bed should be started.

Ants can be kept from the worm bed by supporting the tub on legs placed in water. Proper feeding and watering will keep excess food down and lessen the attraction of ants.

If mice become troublesome, cover the tub with a screen or other porous material that permits air to enter.

The bedding material should be removed at least once a year. Fall is a good time because it marks the end of the summer fishing season and comes before worms bed down for the winter.

Marketing

If you decide to sell the worms, you may either set up your own stand or try to sell through sporting goods stores, hardware stores, or bait shops. Worms are sold by the hundred,but usually 105 worms are counted out. Special boxes for selling worms can be bought from earthworm distributors. Paper cups coated with paraffin will suffice for the local bait stand. Worms should be sold along with some bedding soil. If a layer of damp peat moss is added, worms will survive about 2 weeks.

It's up to the grower to secure locations willing to sell for him or her. Try to maintain accurate records of numbers sold and the cost involved in raising the worms.

Other Related Activities:

1. Study the earthworm
- Earthworms are segmented worms. How do they compare with other worms? What worms are the same? What are different?
- Study the reproduction process of worms. Locate books about worms in a library or from classroom science teachers. What is unique about earthworm reproduction?

2. Raising crickets for bait
- Crickets can be raised at home for bait. A good reference is *Raising Crickets for Fish Bait* by James T. Davis, Texas A&M University Extension.

Notes for Leaders

Although raising earthworms is a flexible, long-term project, it can be divided into three parts for teaching purposes. The following guidelines are important for leaders to consider:

Starting the Worm Bed

- Location is very important. Choose a cool, moist location out of direct sunlight. Remember, the soil must not be too wet, so some sort of drain will be necessary.
- Selection of materials for worm bed frame. Concrete blocks, treated lumber, and rustproof metal will do. Different breeders use various materials.
- Medium for growth (soil). In summer, getting good soil usually is no problem. However, in winter or in an area where good soil is hard to obtain, earthworm soil can be purchased commercially. Potting soil will work if the larger pieces of soil are removed and replaced by fibrous materials. The soil is very important. If you have any questions about its preparation, ask your agent or a local breeder.
- Locating breeder worms may be difficult during certain times of the year. If necessary, locate a commercial producer.

Maintaining the Worm Bed

Because temperature, moisture, and soil content are important, members should be urged to monitor them frequently. If records of procedures are kept, mistakes may be prevented another time.

Using the Adult Earthworms

Deciding what to do with the earthworms after they are raised is an important part of this project. For some members, it may be the most important incentive. Worms may be studied as part of a science project, used as lures for fishing in the *Let's Go Fishing* 4-H project, or sold commercially. If worms are sold, the project becomes a study in economics and sales. Sale containers must be purchased or devised. Records of costs and profits should be kept and market locations selected. Persons at bait shops who have had similar experiences may be the best source of information. Also, check with a tax adviser or the nearest Internal Revenue Service office about tax regulations.

Where Can You Go For Help?

- Cooperative Extension office. Agents have access to materials and resources that can help you.
- Bait shops. Shop operators raise their own worms or have contacts with those who do. Information on materials, soil, and care of worms can be obtained from them.
- Local sportfishers and fishing organizations may know of local breeders. The person who writes an outdoor column for the local newspaper may have this information.
- Commercial breeders named in want ads of outdoor magazines are a last resort.

The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

References used in the development of this activity are:

Click, Jean H., "Bait in Your Basement," *New York State Conservationist,* June–July 1957.

Ramsey, Charles W., and James T. Davis, *Raising Fishworms for Bait,* Texas A&M Extension.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

Entomology and Water

Aquatic Activities for Youth — 3

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

The water habitat provides an excellent laboratory and collection point for the study of insects. A good understanding of insects can help to make a successful fly-tying fisherman, and a good understanding of water can make for a successful insect-gathering trip.

For those who want to find many insects with relative ease, this guide should help.

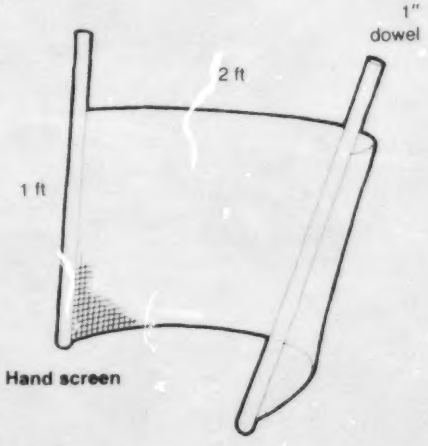
Equipment

Personal equipment:

- Clothing suitable for water including boots, waders, and other waterproof gear.
- A white-bottomed pan for sifting materials (old refrigerator trays are excellent, and plastic bleach bottles cut in half work well).
- A pocket lens, tweezers, insect field guide, and collecting bottles (old baby food jars are good).

Additional collectors:

- A 1 × 2-foot handscreen that can be made from wire door screening and 1-inch dowel rods. It is held in the current by one person while another turns stones and dislodges materials on the upstream side.



Hand screen

- Dip nets for use in ponds.
- Kitchen strainers with long handles for sifting through materials.
- Sand sieve.

Making a Sand Sieve

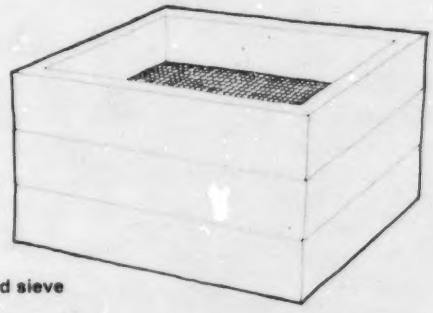
Many aquatic organisms burrow in the mud. A handy way to find them is by using a sieve.

Materials

- light wood crate
- nylon window screen
- nails

Method

- Take a screw driver or claw hammer and pry the bottom of the crate off.
- Measure and draw a line halfway up (on the inside) of the crate.
- Cut the screen so that it is 3 or 4 inches wider and longer than the inside of the crate.
- Nail the screen along the line drawn inside of the crate.
- Your sieve is now ready for use.



Sand sieve

Where to Look for Organisms

Since water provides the home for the immature stages of many adult insects, a collecting trip along the banks of a pond and stream will provide success for the young entomologist. Riffles are the areas in streams that provide the most insects. Here, the oxygen content is high because the water washes over rocks. Insects can also be found in the mud on the bottom of the pond or stream. Look under rocks, too, because they provide shelter for many organisms of interest. Insects can also be sorted from bottom sediments the same way they are sorted from "trash" on the forest floor.

What Will Be Found

The larvae of many of the Diptera (flies) and Coleoptera (beetles) can be found, as well as the nymphs and larvae of such orders of insects as mayflies, stoneflies, dragonflies, dobsonflies, and caddisflies. The observant person can find several stages of insect growth in a relatively small area and will gain a concept of the food web in streams.

Once the insects are collected, preservation and display techniques for the project are the same as those for the 4-H entomology project, which is available at your local extension 4-H office.

The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

The author would like to thank Linda O'Dierno for her help in the writing of this activity.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What Is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

Rope

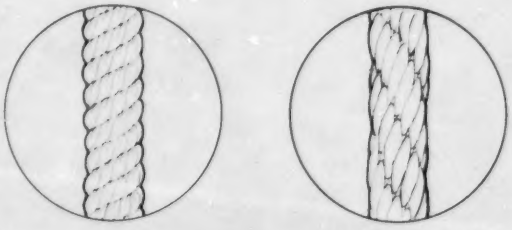
Aquatic Activities for Youth — 4

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Rope is widely used in the fishing industry for mooring lines, rigging, and trawl and trapline nets. Different types of ropes have different qualities that lend themselves to particular jobs. This discussion and short activity is designed to give the student an understanding of rope.

Rotating and Nonrotating Rope

Because all the strands are wound in the same direction, rotating ropes tend to turn when a load is applied. This turning gives them their name. Because of their construction, three- or four-strand, right- or left-lay ropes are rotating ropes (A). Nonrotating ropes have an equal number of left-lay or right-lay strands. The most common type of nonrotating rope is the braided rope (B).



(A) Three-strand rotating rope (B) Braided non-rotating rope

Types of Rope Materials

Manila is the most commonly used natural fiber rope in the fishing industry. It is heavier than synthetic rope because more rope is needed to produce the same strength and because manila soaks up water. It ages rapidly and is weaker than synthetic rope, pound for pound. In large part, manila rope has been replaced by synthetic rope, except in special cases.

Polyester is an excellent, but expensive, substitute for manila. Because of its cost, it has not been accepted quickly as a replacement for manila. Polyester (such as Dacron) is second to nylon in elasticity (ability to return to normal length after stretching) and stretches less than nylon under heavy loads. It is the most abrasion-resistant of the commonly used ropes.

Nylon has great ability to return to normal length after stretching and is good when an initial shock is given to the rope. It stretches a great deal, however, and this can be a drawback.

Polypropylene is the lightest of synthetic ropes; it is strong and long lasting in use and storage. This rope is also expensive.

Blends of nylon, polyester, and polypropylene are being used to take advantage of desirable characteristics and as cheaper substitutes for polyester. Two synthetic ropes are used for special jobs. Nolaro stretches very little, and Mylar has electrical conductors. Blends are being used more and more in rigging and trawl nets.

Knots weaken a rope and should be avoided when possible. Knots in synthetic rope can tighten so much under heavy loads that they can't be untied.

Activity: *Three-Strand Construction*

A rotating rope can be made with materials that are easily obtained. It is constructed by twisting strands around one another in the same direction. In this activity, you will make a three-strand rope and learn about two major problems this type of rope has. *Hockling* is when strands running through the inside of a rope pop through the outer strands after the rope has been stretched by a heavy load. This happens because the strands are laid individually and stretch to different degrees. *Kinking* occurs when the rope is turned too many times with its lay, causing the rope to "unlay" if it rotates back to its original position. Braided rope was developed to prevent these problems, but it is sometimes hard to grasp because of its smoothness.

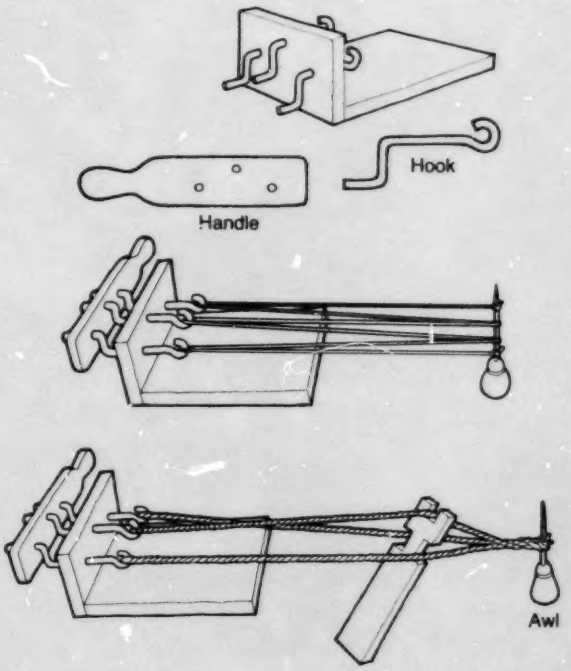
Rope Machine. To make your own rope machine, you will need:

- 3 boards of ¾–1-inch pine: 2 approximately 5 inches wide, and 1 suitable to be used as handle (at least 2 inches wide)
- Drill with $^{3}/_{16}$-inch drill bit
- Several 1¼-inch to 1½-inch screws
- Fork stick (approximately 6 inches long with 3-inch forks)
- ⅛-inch wire (coathanger wire works well)
- C clamp
- Binder twine (approximately 7 times the length rope you desire)
- Awl or 3-inch board with single screw hook (see diagram)

Procedure: Using screws, attach the two 5-inch boards at right angles, and drill three $^3/_{16}$-inch holes about 1 inch apart, the middle hole slightly higher than the other two. Drill similar holes in the wood to be used as handle. Make hooks out of ⅛-inch wire, and insert hooks in holes of angled board and handle. Hooks should move smoothly in the holes. Use C clamp to fasten the angled board to the flat surface. Now you are ready to make the rope. Measure a length of twine approximately 7 times length of rope desired. Fasten one end of twine to the awl or screw hook. Run twine to hook on angled board and return to awl. Repeat procedure to second hook and back to awl. Return to third hook and back to awl.

Turn handle in one direction only until you can feel good tension in strands as they turn on themselves. Overwinding will cause kinking. Underwinding will make loose rope that will unlay. Use the forked stick to keep strands separated. Because this technique causes strands to be used equally, it prevents hockling. When tension is great enough that the twine wraps itself, remove the awl. The twine strands should twist quickly into single strand. Remove rope from machine, and tie both ends using overhand knot. Now you have a three-strand rotating rope.

A three-strand rope is adequate for most uses. Where there is a free end such as an anchor, a float mooring, or a trap mooring, a nonrotating rope might be used to better advantage.



The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

This activity was adapted from the following sources:

"Characteristics of Rope used in the Fishing Industry," Bruce Wyatt and Christopher Dewees, Sea Grant Marine Advisory Leaflet 2727 University of California.

A Leader's Guide to Nature-Oriented Activities, by Betty van der Smissen and Oswald H. Goering. The Iowa State University Press 1965.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What Is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

Calculating Stream Flow

Aquatic Activities for Youth — 5

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Just how much water flows down that stream by your home that you have always taken for granted? If all this water were used for drinking, washing clothes, and the like, how many people could use it each day? The following activity will give you an idea.

Objectives

Each person should be able to determine the rate of flow of water in a small- to medium-sized stream. From this calculation, the individual can determine the amount of water that passes a certain point and thus gain an insight into erosion, flooding, water use, and the water power of a typical stream.

Basic Concepts

The stream is an important part of the water cycle. Surface water provides a needed resource to many communities.

Limitations

This activity can be done by groups aged 9–19 where basic arithmetic skills are present. Boots or waders should be worn. If the water is warm enough, old sneakers can be used to protect feet. Be careful of sharp objects and dropoffs in the stream. Streams should be narrow and shallow enough to determine average width and depth.

Materials

- 50-foot rope marked off in 5-foot sections, or another means of measuring widths and lengths of over 10 feet
- Yardstick
- Cork, table tennis ball, or object that floats easily
- Watch or stop watch
- Large pad of paper or newsprint and marking pencils
- Optional: two meter sticks, two 8-penny nails

Activity Time

About ½ hour to 45 minutes.

Procedure

Assemble researchers at base camp to explain entire activity, and divide into smaller groups if needed. This activity works best with 4 to 6 people in each group. If many people are present, "research" teams of 4 to 6 can be set up. Results then can be compared and averaged to find a representative flow answer.

Each small group should have one recorder and several surveyors.

Recorder

It is the job of the recorder to keep track of all measurements taken by the team.

Surveyors

- Mark out a 100-foot section of a stream that is fairly uniform in width. By measuring at several places, you can determine the average width.
- Using a yardstick, determine the average depth of the stream by measuring three times in at least three places. One measurement should be taken in the deepest portion of the stream and two others along the banks.

Reporting

Older groups can make calculations and report team findings to the entire group at the base camp. For younger groups, use newsprint to pool the calculations of all teams. All group measurements can be averaged for final calculations. Velocity can be determined by solving this equation:

$$\text{Volume of flow} = \frac{{}^{*}(\text{average width in feet}) \times (\text{average depth in feet}) \times (\text{length of section})}{\text{Time in seconds}}$$

*Multiply by 0.8 if bottom is rocky and 0.9 if smooth or sandy.

Volume of flow × 7.5 = gallons of water

If, on the average, each person uses 10 gallons of water per day, how many people can the stream serve?

Optional Activity

Another way to measure stream flow is to use the Thrupp method. To construct a Thrupp apparatus, attach the zero end of one meter stick to the 50-cm point of another to form a T. On the meter stick that makes the horizontal part of the T, drive two nails 15 cm apart at the 42.5-cm point and the 57.5-cm point.

To operate, simply hold crossbar upstream so only the nail heads are exposed above the surface of the water. Measure where the Vs formed in the water current by the nails intersect along the outside T. Use the following equation to determine the flow:

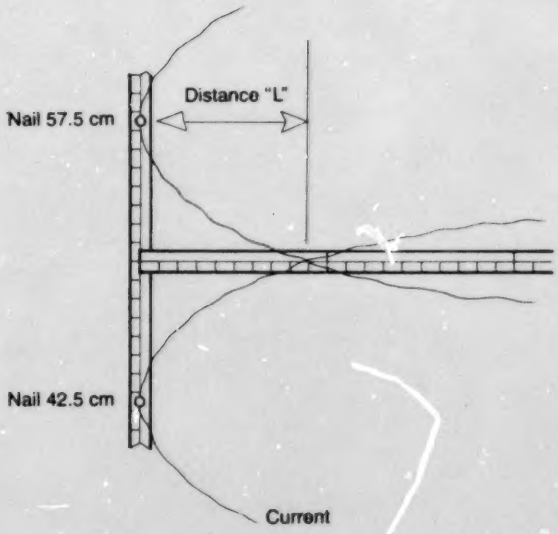
Flow = 0.1466 × Distance along T *of intersection*

Flow is in meters per second. By measuring in meters the average width and depth of the stream, determine volume of water:

Flow volume = flow × width × depth

1 cu meter = 264 gallons of water

How many gallons in the flow?



The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

This activity was adapted from the following sources:

Earl Leitritz, *Trout and Salmon Culture,* California Department of Fish and Game, Fish Bulletin 107, 1959.

L.S.U. Marine Science Teaching Aid, Issue 1, October 1972.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York, NY 10006

What is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

Cobbler's Cove:

A Simulation of Coastal Planning

Aquatic Activities for Youth — 6

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

A marina facility in Cobbler's Cove was purchased by a group of merchants who intend to develop the facility and improve marina services. Boat slips in other marinas in the area are all full, and additional docking space is needed in the region.

The existing facilities include 125 boat slips with electricity and fresh water, a gas dock, and a shop that sells live bait. Plans for development include an additional 125 boat slips, new docks, a launching ramp for trailered boats, a boat showroom for sales and service, and a new parking area for 200 cars. It is expected that with this new development, a restaurant and a new fishing tackle and bait shop will probably be built to accommodate visitors.

To build the additional boat slips, part of a cattail marsh upstream of the present marina will have to be removed. A new boat channel also will have to be dredged. The new buildings will be built on what is now a wooded area, and the adjacent parking lot will pave a grassy area that has been popular for picnicking.

Step 1

Your first step is to consider the environmental, social, and economic advantages and disadvantages of the project plan. Each team should appoint a recorder to write down the group's ideas. At the end of 10 minutes, each recorder should give a one-minute report on the group's findings.

Step 2

For the second step, each team should take 10 minutes to list the three best alternatives to the plan. For example, you may want to tear down, build, relocate, or redesign facilities. Choose a new recorder. He or she will give another short report on the team's decisions. All alternatives will be listed by the leader on a blackboard or a large sheet of paper.

Step 3

Each group should consider all of the alternatives listed and devise a new project plan, using the blank maps provided. The project plan can include any alternatives listed in Step 2 or other changes or compromises.

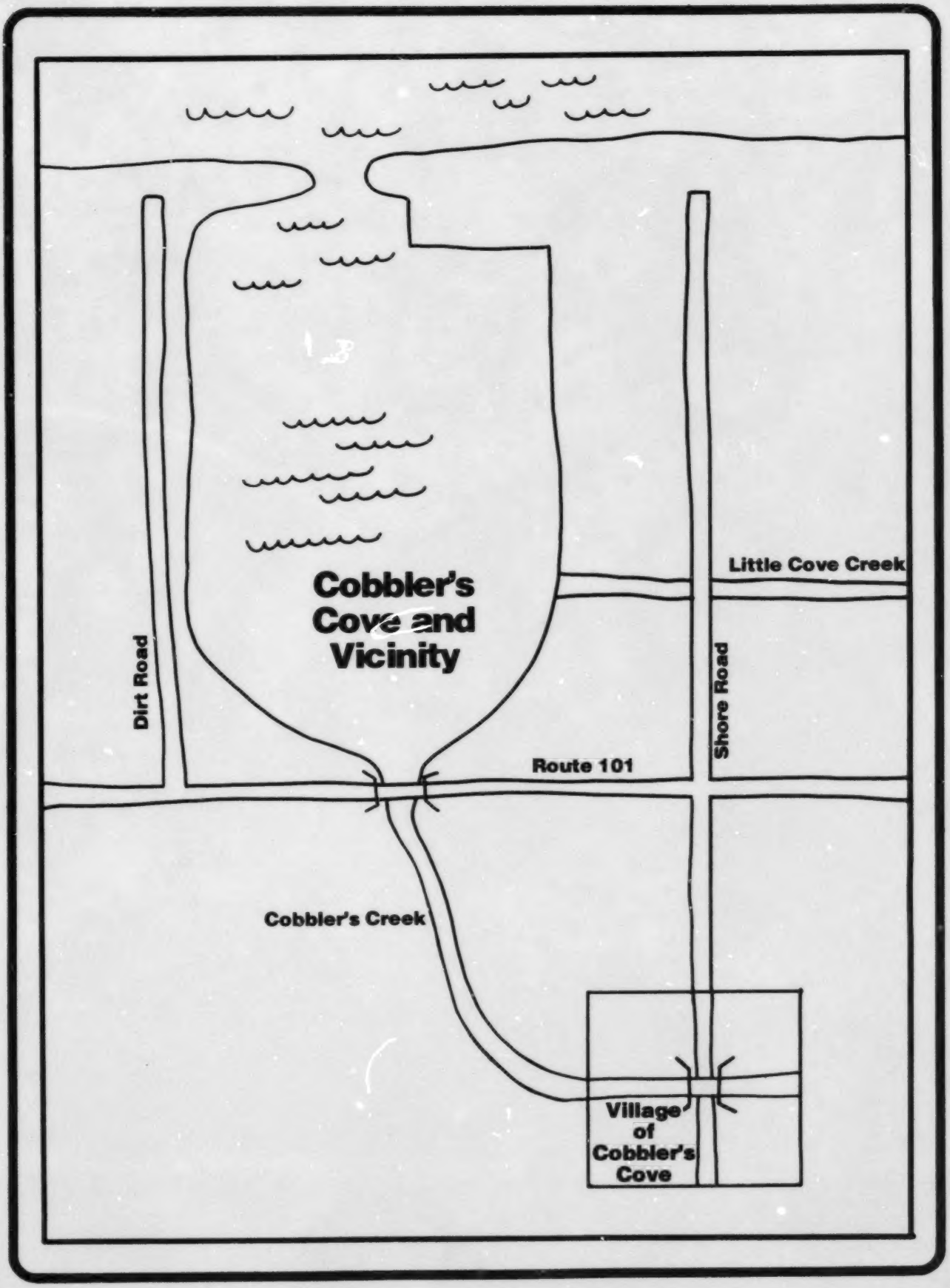
Step 4

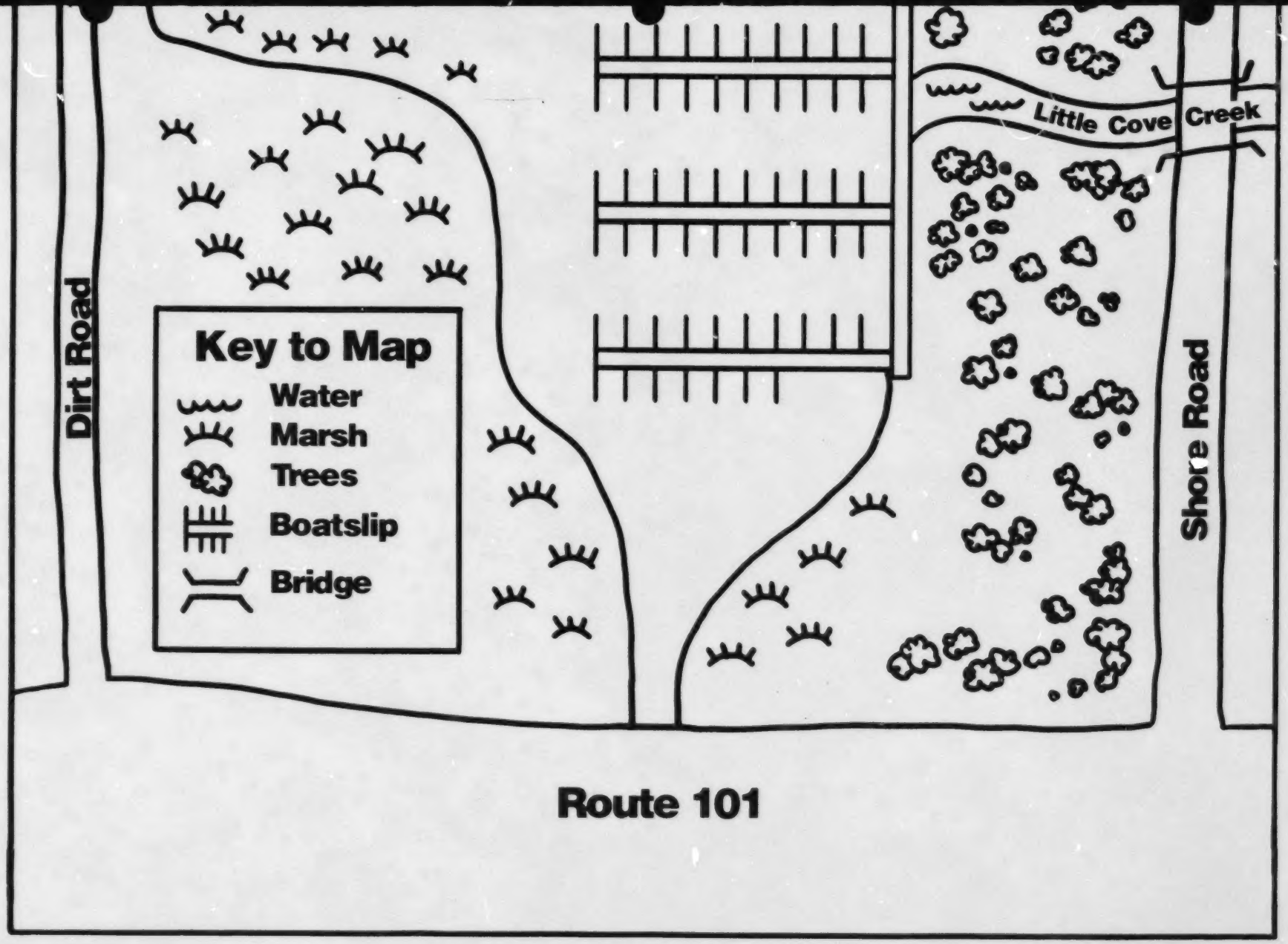
A new recorder for each team should point out the major features of his or her team's plan. Then the teams should vote on the best three plans.

If Cobbler's Cove were an actual case of marina development, it would be necessary to obtain permits from both the New York State Department of Environmental Conservation and the U.S. Army Corps of Engineers. Permit applications are printed in the local newspaper. The public has the opportunity to offer comments; in some cases, a public hearing is scheduled. In this way, the public is guaranteed the opportunity to participate in environmental decision making.

In addition to this permit approval process, the National Environmental Policy Act of 1970 requires each federal agency to prepare an environmental impact statement before taking any action that may significantly affect the quality of the human environment. Citizens have the opportunity to offer comments on environmental impact statements and, in fact, have brought some cases to court to ensure the quality of their environment.

Which of your three plans do you think the government should approve? Vote again for one plan.


Cobbler's Cove and Vicinity
Little Cove Creek
Dirt Road
Shore Road
Route 101
Cobbler's Creek
Village of Cobbler's Cove


Dirt Road
Little Cove Creek
Shore Road
Key to Map
Water
Marsh
Trees
Boatslip
Bridge
Route 101

Aquatic Activities for Youth — 6

Notes for Leaders

This activity can help youngsters learn more about our coastal environment and about planning for use of the coastal zone. A slide set with script on the coastal zone may be obtained from either of the two offices listed at the end of this sheet.

- The slide program "Cobbler's Cove", which takes about 15 minutes, may be shown to students first to acquaint them with the coastal zone. It will explain what our coastal areas offer and what problems they face.
- Students will need to use the activity sheet entitled "Cobbler's Cove: A Simulation of Coastal Planning." It will allow them to explore the consequences of various actions on the coast.
- The following description explains the leader's role in this simulation of coastal planning. Be sure to pull these leader's notes before distributing activity sheets to your group.

Leader's Role

Set the stage. Arouse curiosity and interest among the participants in the subject of environmental impact by asking a question such as: What would happen if a marina were built near a marsh teeming with wildlife? a highway were constructed through a forest? a power-generating plant were built in your community? Identify a local situation if one exists.

Slide set. Show the slides and read the script.

Divide into groups. Divide your group into teams of four to six members with a maximum of six groups. Supply each group with one copy of the activity sheet, which contains the project plan and attached maps.

Explain that the type of marina development described is common. Each group will be acting as a council of concerned citizens in the community where the marina development is proposed. Assign a role for each person to play (angler, boater, parent, environmental activist, local politician, businessperson, etc.) Follow these steps:

Step 1.

Have each group consider the environmental, social, and economic advantages and disadvantages of the project plan. At the end of 10 minutes, the appointed recorder for each team should give a one-minute report of the group's findings. Some possible answers for Step 1 are as follows:

- No more crowded marina facilities,
- More people can enjoy the area,
- The area will become too crowded with people,
- More money brought into the community,
- Jobs created to provide services,
- More pollution as a result of more cars, more boats, and more litter,
- Restaurant, tackle, and boat shops may compete with shops in the village,
- Wooded and grassy areas will not be available for recreation,
- Dredging for a new boat channel will decrease water quality,
- Material that is dredged (dredge spoils) will have to be deposited somewhere (on land or in water),
- Cattail marsh will be destroyed. This marsh serves to filter the water as it travels downstream and serves as a buffer against water damage during storms. If destroyed, it would no longer provide for fish and wildlife (ducks, raccoons, muskrats, shore birds), and hunting and fishing activities would decrease.

Step 2.

Have each team, using a new recorder, take 10 minutes to list the best three alternatives to the plan. As each recorder explains the alternatives, the leader should write them down on the blackboard or on a large sheet of paper. Some possible alternatives to the proposed plans are as follows:

- Leave it the way it is,
- Remove existing boat slips from the west side of the cove and replace with the same design as on the east side (also the same design proposed) and decrease the number of slips, if necessary, to protect the marsh,
- Eliminate the launching ramp; have only boats in slips,
- Do not build new boat slips, but increase the number or size of launching ramps to allow more trailered boats (need more parking space for trailers),
- Put roof-top parking on top of the new buildings,
- Put new buildings in the village instead of around the cove, the wooded and grassy areas being saved for recreation,
- Build a bridge over the mouth of the cove to provide easier access to the other side,
- Dredge out Little Cobbler Creek and put in boat slips there to save the marsh,
- Install a sewage pumpout service at the gas dock where boats can have their sewage holding tanks pumped out and cleaned,
- Build smaller boat slips and limit the size of the boats,
- Provide a boat rental service so everybody won't have to own their own,
- Provide campground facilities nearby,
- Build a breakwall or breakwalls out into the water and provide boatslips or moorings in the lake,
- Don't build new boat slips, but build a dry-stack boat storage system, that is, a building on the land with racks that hold boats. A fork-lift type truck can remove and replace the boats and put them into and out of the water at the owner's request.

Step 3.

Have each group, using the maps provided, devise a new project plan. Explain that this plan can include any alternatives listed in Step 2 or other changes or compromises.

Step 4.

Have the groups vote for the best three project plans.

Concluding. Summarize briefly what happens to such plans in real life. The question to raise now is, How can individuals help influence the quality of their environment? Two points to consider are as follows:

- This type of coastal development requires permits from both the New York State Department of Environmental Conservation and the U.S. Army Corps of Engineers. Permit applications are printed in the local newspaper. The public has the opportunity to offer comments; in some cases, a public hearing may be scheduled. In this way, the public is guaranteed the opportunity to participate in environmental decision making, either through permit applications or environmental impact statements.
- The National Environmental Policy Act of 1970 requires each federal agency to prepare an environmental impact statement before taking any action that may significantly affect the quality of the human environment. Citizens have the opportunity to offer comments on environmental impact statements and, in fact, have brought some cases into court to ensure the quality of their environment.

The author of this activity is Sandor Schuman, Sea Grant specialist—Oswego, assisted by Leslie Ware and Sally Willson, Sea Grant specialists — Ithaca; Michael W. Duttweiler, assistant program leader–Sea Grant; and David Greene, Sea Grant specialist — East Aurora.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, NY 14052

Marine Education Program
111 Broadway, Suite 1700
New York NY 10006

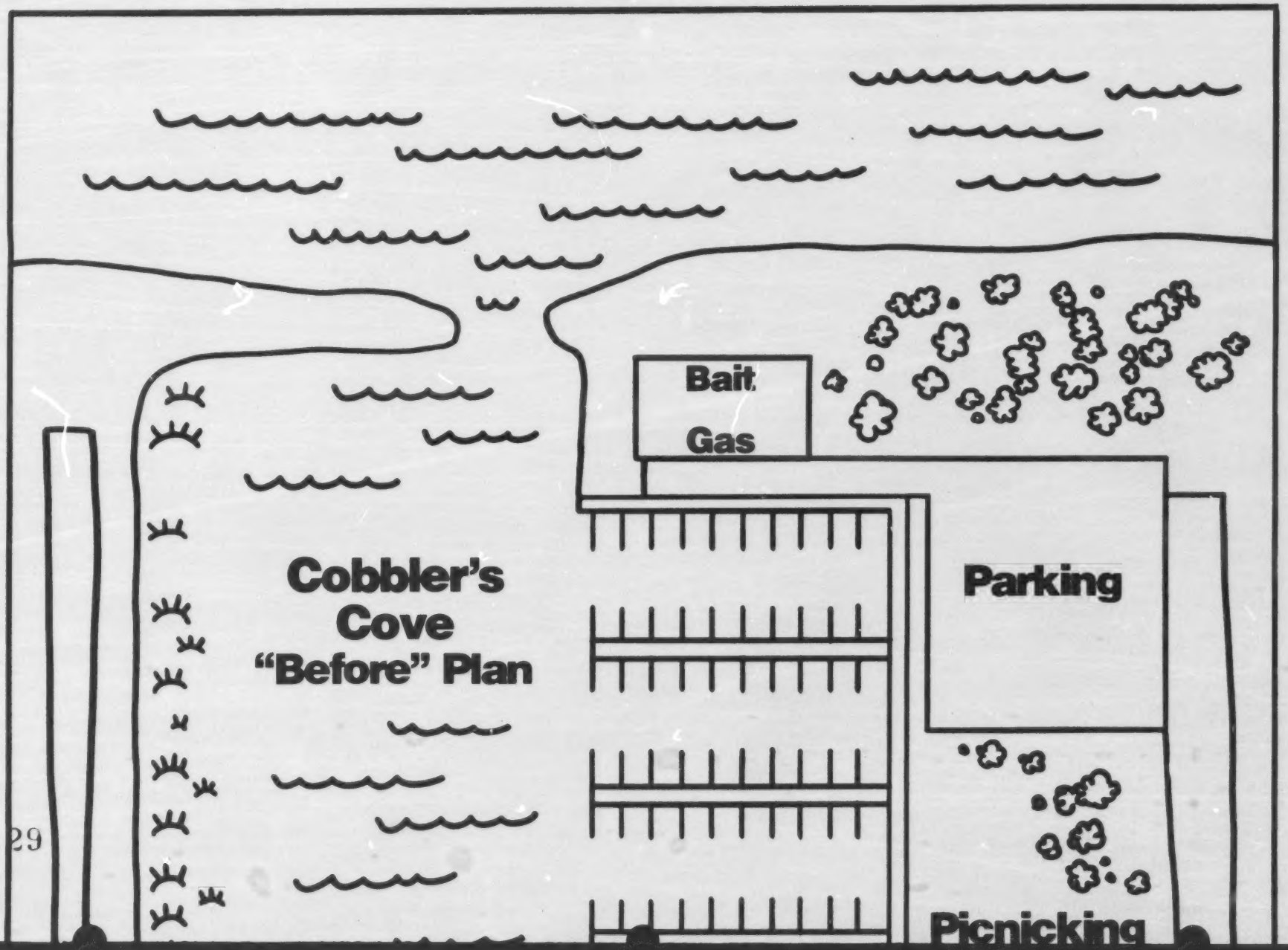
What is Sea Grant?

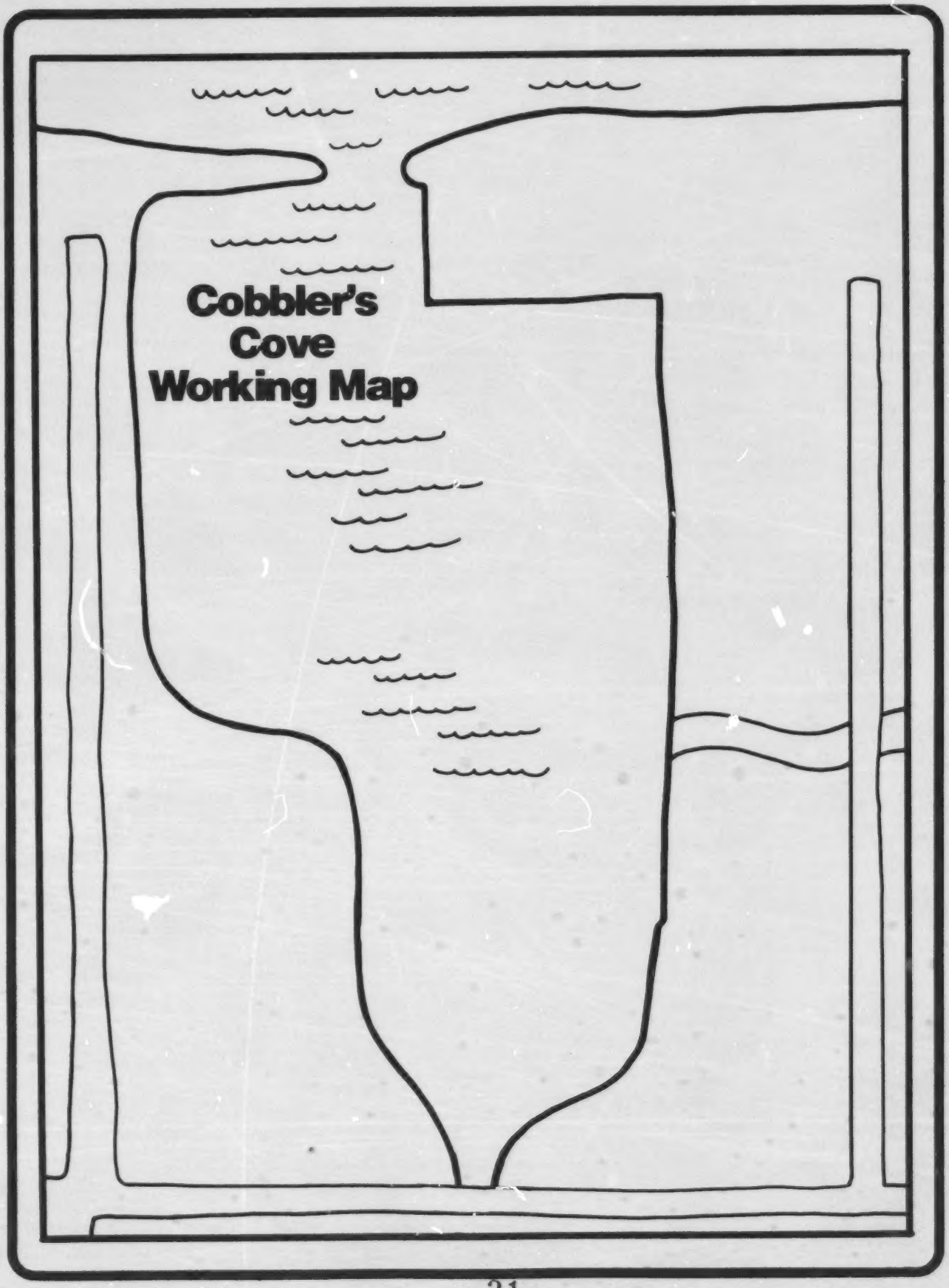
Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

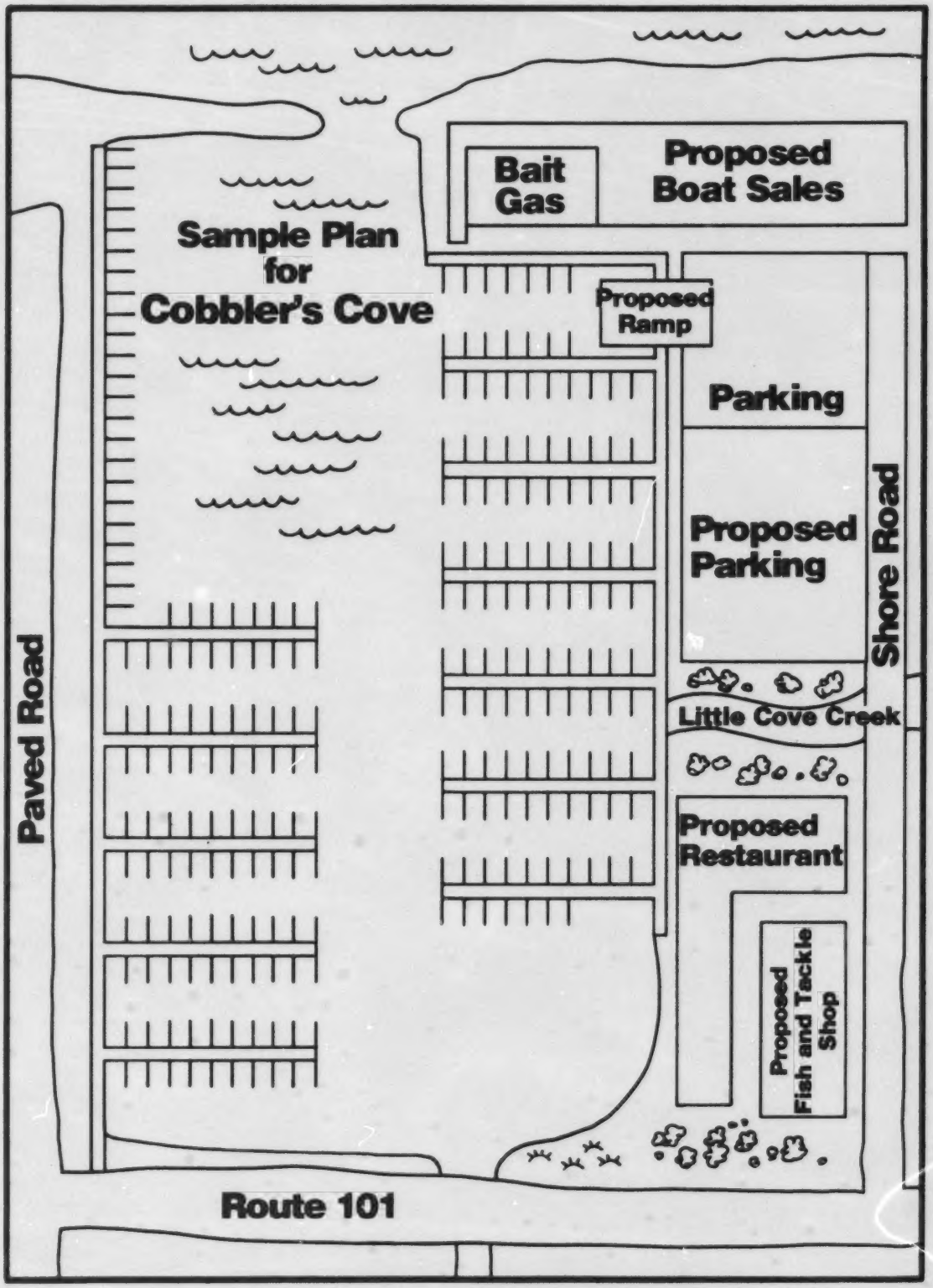
Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the New York State Sea Grant Program using their own funds as well as state and federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.


Bait
Gas
Cobbler's
Cove
"Before" Plan
Parking
Picnicking


Cobbler's
Cove
Working Map



Price per copy 35 cents.

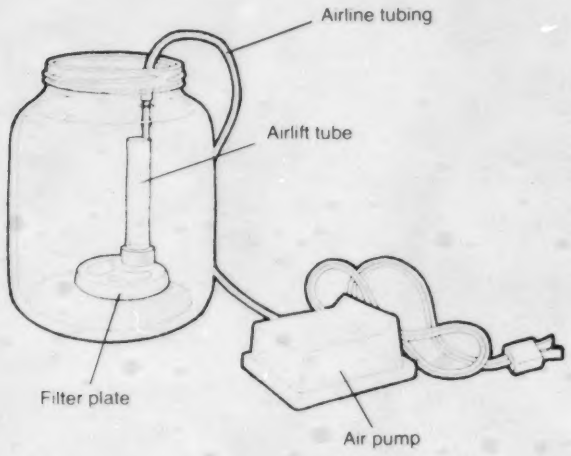
Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408

A Saltwater World in a Jar

Aquatic Activities for Youth — 7

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

You can easily make an inexpensive saltwater aquarium out of a gallon jar. You also need a goldfish bowl filter, a small air pump, some oyster shells, and salt water. You can either collect your aquarium critters on a field trip to the shore or, if you live inland, you can buy special saltwater species at a local pet shop. Be sure that any fish or invertebrates (animals without backbones like shrimp, sea anemones, and shellfish) that you buy are from temperate, not tropical waters. Tropical animals have special temperature requirements. Fresh fish markets are sometimes a good source of crabs and snails for your aquarium.



The Container

Wide-mouthed (4.5 inches, 11.4 cm) 1-gallon glass jars can often be obtained from the school cafeteria or a local restaurant. Many hot dog stands get mustard and ketchup in large jars and would be willing to give you one. Clean the jar carefully, but don't use any soap. No matter how hard you try, you'll never get all the soap out. If you must, you can use either baking soda or salt to make the jar as clean as possible.

Location

Select a site on a sturdy table or countertop away from radiators and direct sunlight. If the location is too sunny, algae will grow on the walls of your tank. The cooler the location, the better. Saltwater fish like cool water. Remember: fish breathe the oxygen dissolved in the water, and cool water can hold more oxygen than hot water. The fish remove the oxygen by taking water into their mouths and then passing it through their gills.

The Water

You can either use natural seawater for your aquarium or eliminate the problems of hauling water from the shore by using one of the synthetic sea salts that are available in pet stores. Seawater contains many types of salts in a delicate balance, so don't try to improvise with table salt (sodium chloride).

If you want to collect your own seawater, carry it in a plastic pail lined with a plastic trash bag. When the pail is full, simply close the top of the bag with a twist tie to keep the water from sloshing. One gallon of water weighs over 8 pounds, so don't fill the pail with more water than you can lift. Try to collect your water as far out from the shore as possible, because water near the shore tends to be more polluted.

Fill the gallon jar only to its widest point. This will allow the maximum exchange between air and water and thus provide the best aeration.

If you use synthetic salts, follow the directions on the package. These synthetic salts do not contain the microscopic life and organic material essential to a healthy aquarium. To provide these materials, you should have a 2-week run-in period when the only tenant in your tank is a crab. Marine organisms produce ammonia as a waste product. In the open ocean, the poisonous ammonia is harmless because it is diluted by the great amount of water. In a small tank, ammonia can build up and kill the organisms. Crabs, which are extremely resistant to this buildup, can survive where other organisms would die. You can also start a new tank simply by seeding it with some gravel from another older tank that has already built up a population of bacteria.

Filtration and Aeration

Because salt water tends to hold less oxygen than fresh water, a saltwater aquarium must have a good source of oxygen. Oxygen not only allows the fish to breathe, but also allows for the buildup of aerobic (oxygen-using) bacteria, which break down poisonous waste materials in the tank. Without these friendly bac-

teria, your tank would quickly poison itself. One type of bacteria, *Nitrosomas*, breaks the ammonia down into nitrites. A second type of bacteria known as *Nitrobacter* changes the nitrites to harmless nitrates. Most marine animals are relatively tolerant to the buildup of nitrates, but the level should be reduced by changing about one-fifth of the water every 2 weeks.

For filtration and aeration, use a goldfish bowl filter, which fits neatly into a 1-gallon jar. This type of undergravel filter works as a biological filter system. The air pump forces air bubbles into the water. This air–water mixture is lighter than the plain water in the jar. The lighter air–water mixture rises to the top and forces the plain water down through the filter. Large waste particles are trapped by the gravel as the water passes through.

If your tank includes clams, mussels, barnacles, or sea anemones, avoid a system that filters all materials from the water. These animals are natural filters and will starve to death if the filter in your tank is too effective.

Substrate

Substrate is the material that covers the bottom of the tank. A good substrate for a marine tank is dolomitic limestone, which is available at a pet store, or crushed oyster shells which you can make yourself. If you are going to crush your own oyster shells, put the shells between a few sheets of newspaper and crush them with a hammer. The newspaper will make it easy to clean up, and, more importantly, it will prevent any pieces of shell from flying up into your eyes. Don't hit them too hard because you want to get pieces that are too large to fit through the openings in the filter. Also, there must be space for water under the filter. If the crushed particles are too small, you can cover the filter plate with a nylon stocking to reduce the size of the openings.

Before putting the gravel into the tank, rinse it with tap water until the runoff is clear. The layer of substrate should be about 2 inches deep. Most people have poor success trying to maintain marine plants, so you're better off without these. However, you should provide some plastic plants to provide hiding places for the animals.

Temperature

The best temperature is similar to that of the animal's natural habitat. It is usually lower than room temperature. Don't put your tank too close to a light because it may raise the temperature of the water. Adding an ice cube to the tank every morning keeps the temperature down and makes up for water lost by evaporation. When the water evaporates, salt is left behind, and the saltiness of the water increases. Test it yourself: put some salt water into a dish and place it on a sunny windowsill. What do you find after the water has evaporated?

Remember that warm water holds less oxygen than cold water. Again, run your own test: make two trays of ice cubes, but use hot water for one and cold water for the other. When the water has frozen, examine both types of ice cube. How do they differ? Why are the cubes made with cold water cloudier than those made with hot water?

Most marine organisms tolerate a temperature range from 40–70°F and can tolerate *gradual* temperature changes.

pH Level

Scientists use the abbreviation *pH* to tell how acidic or basic something is. Vinegar and lemon juice are examples of acids. Baking soda and ammonia are examples of bases. The pH scale runs from 0 to 14. Water with a pH of 7.0 is neutral. As the pH drops below 7, we say the substance is acidic. The lower the number, the more acidic it is. As it rises above 7, it becomes increasingly basic. If a chemical has a pH of 13, is it an acid or a base? What if it has a pH of 3?

The pH of the water in your tank should range from 7.5 to 8.3. As the water in the tank ages, though, it has a tendency to become more acidic. The dolomitic limestone or crushed oyster shell that you used as a substrate is important in maintaining the proper pH of your tank. It provides what scientists call a *buffer*. A buffer is a chemical that helps to keep the pH constant.

If you find that the pH of your tank is dropping, add a small piece of chalk or a little baking soda. Both of these substances are buffers. You can test the water by using pH paper or a pH test kit obtained from your science teacher.

Density – Salinity

The density of something is how much a certain amount of that substance weighs. Lead would have a high density because a cube that measures 1 inch on each side would be heavy; cotton would have a low density because a cube that measures 1 inch on each side would be light.

A *hydrometer* is a device used to measure density. It is a glass tube weighted at the bottom so that it floats at a certain level in the water. Density becomes greater with increased saltiness. The saltier the water, the higher the hydrometer will float. The numbers on the hydrometer scale run from 1.000 to 1.025.

Before reading the hydrometer, unplug the air pump to calm the surface of the water. Density is also affected by temperature. Use the chart below to find the appropriate density of seawater at each temperature.

If the water is too salty (that is, if the hydrometer reading is higher than the number on the chart), add fresh water until the hydrometer floats at the correct level.

Temperature	Density
60°	1.0240–1.0245
65°	1.0235–1.0240
70°	1.0230–1.0235
75°	1.0225–1.0230
80°	1.0220–1.0225

Feeding

Most marine animals thrive on a diet of frozen fish or clams. Overfeeding can be a major problem. The animals should be able to clean up all their food in about 5 minutes. Remove any leftovers before they foul the tank. They can be removed with a turkey baster, which is less expensive than an aquarium vacuum.

General Maintenance

A gallon jar aquarium can generally support two or three animals, depending upon their size. If any of the animals looks sick, remove it immediately to a "hospital tank." If you keep hermit crabs, provide some larger shells so the animals can move when they become cramped.

Algae can be carefully scraped off the walls of the tank with a single-edged razor blade and sucked out with the kitchen baster.

Cloudy water generally indicates an unwanted growth of bacteria. The best thing to do in this case is to start the tank over again with new water.

Tank water can easily become poisoned. Make sure that no metal ever comes in contact with the water. If you suspect that the tank has been poisoned, dilute the poison by changing about half of the water immediately.

Keep a daily log of your tank. Record information about pH, temperature, salinity, and any changes that you observe in the animals.

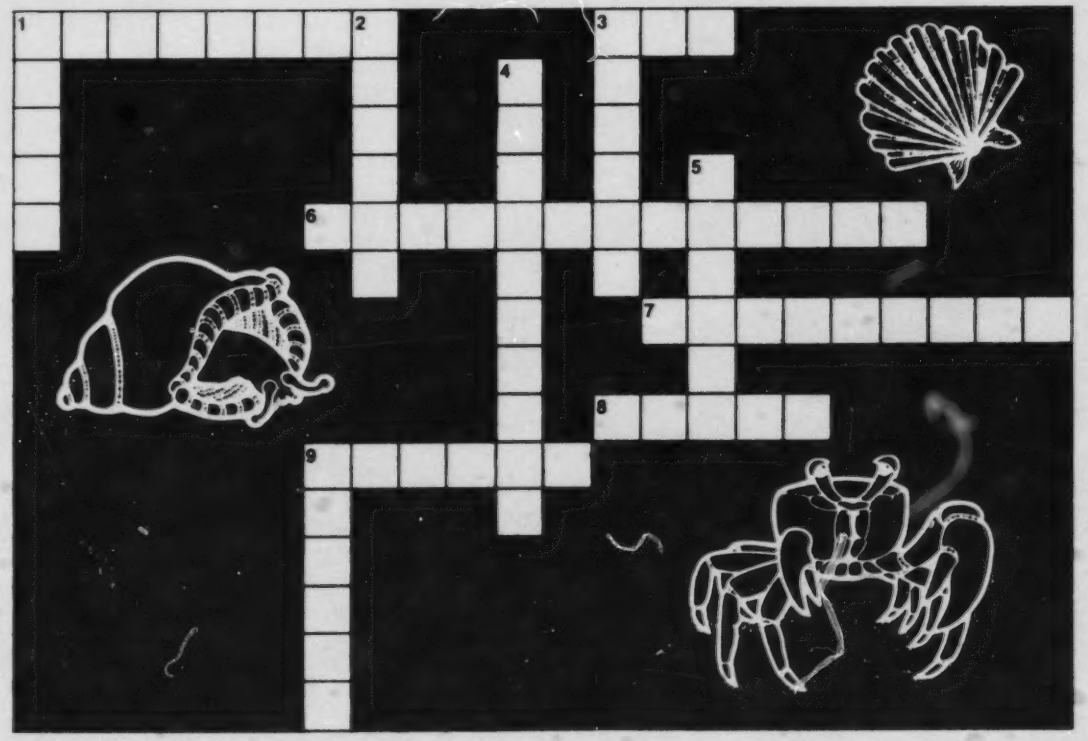
LOG	Temperature	pH	Salinity	Animal condition
Oct. 1	75°	7.5	1.0225	
Oct. 2	80°	7.5	1.0220	
Oct. 3	80°	7.7	1.0225	Herman the hermit crab moved to a larger shell
Oct. 4	70°	8.0	1.0230	

Across

1. Tank in which we put plants and fish
3. Body part that allows a fish to move
6. Animals without backbones
7. When water changes to vapor
8. Body part that a fish uses to breathe
9. What fish breathe

Down

1. Plant growth on sides of tank
2. Term meaning salt water
3. Device that cleans aquarium water
4. Device to measure density
5. Aquarium substrate
9. Animal that makes pearls



Developed by the New York City Sea Grant Office — Cornell University — Cooperative Extension

Notes for Leaders

One advantage to using gallon jars for aquariums is that one large air pump can supply several jars, and teams of students can maintain their own aquariums. With a series of gang valves, you can run 10 gallon jars off of one large, silent-type air pump. Although this type of pump is relatively expensive (about $20.00), it tends to last a long time, runs quietly, and can aerate a large quantity of water.

Sometimes individuals are willing to donate fish tanks and equipment to schools. Teachers might find tanks by placing ads in local newspapers. With a letter on school stationery to acknowledge the contribution, the donor can take a tax deduction, and the teacher gets a free aquarium.

When selecting a site for your tank, remember that incandescent lights produce heat; fluorescent lights don't. A fluorescent lamp will stimulate the growth of algae on the walls of the tank without increasing the temperature. The algae can then be scraped off and studied under the microscope.

Volatile substances dissolve quickly in salt water. Fumes from paint and proximity to animals such as hamsters or mice can kill your marine animals. The waste products from these mammals dissolve in the air and subsequently find their way into your aquarium.

Related Activities

- Raising brine shrimp
- Maintaining records and graphs
- Observation
- Using keys
- Word puzzles
- Math problems
- Reading temperature scales
- Using the metric system
- Measuring
- Constructing collecting equipment
- Photosynthesis and plant pigments
- Testing pH
- Investigating properties of water
- Research and writing compositions
- Reading maps

This unit was produced by:
Linda J. O'Dierno
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
Telephone: 212-587-9722

and edited by:
Leslie Ware
New York Sea Grant

Glossary

Aerobic — Requiring oxygen
Bacteria — Microscopic organisms, some of which are useful to human beings and some harmful
Density — The weight of a certain amount of a substance
Evaporation — When water changes from a liquid to a gas
Habitat — Place where a plant or animal lives and grows
Hydrometer — Device to measure density or salinity
Invertebrates — Animals without backbones, like crabs and clams
Nitrobacter — Type of bacteria that changes nitrites into harmless nitrates
Nitrosomas — Type of bacteria that changes ammonia into nitrites
Salinity — How salty something is
Toxic — Poisonous

Further Reading

Axelrod, Herbert R. and Will Vorderwinkler. *Saltwater Aquarium Fish.* T.F.H. Publications, Jersey City, New Jersey, 1967.

Spotte, Stephen H. *Fish and Invertebrate Culture: Water Management in Enclosed Systems.* Wiley-Interscience, New York, 1970.

Straughan, Robert P. L. 4th rev. ed. *The Saltwater Aquarium in the Home.* A. S. Barnes and Company, Cranbury, New Jersey, 1975.

Waters, Barbara and Waters, John. *Salt Water Aquariums.* Holiday House, 1967.

Answers to crossword puzzle:
Across: 1. *aquarium;* 3. *fin;* 6. *invertebrates;* 7. *evaporate;* 8. *gills;* 9. *oxygen.*
Down: 1. *algae;* 2. *marine;* 3. *filter;* 4. *hydrometer;* 5. *gravel;* 9. *oyster.*

What is Sea Grant?

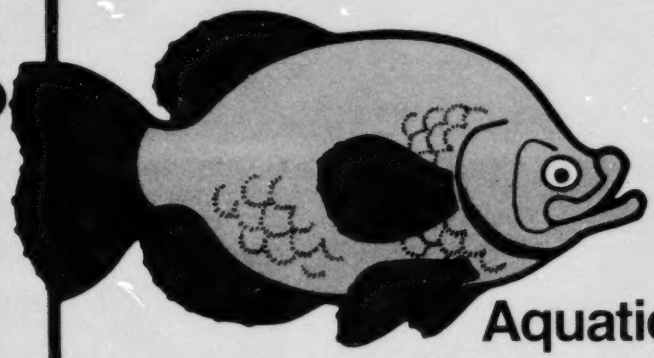
Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408



Fish in Your Diet

Aquatic Activities for Youth — 8

SEA GRANT • COOPERATIVE EXTENSION • NEW YORK STATE • CORNELL UNIVERSITY

Variety is the catchword with fish. More than 240 commercial species of fish and shellfish are marketed in the United States today. Fish can be bought fresh, frozen, canned, dried, salted, smoked, and in convenient processed forms.

For a relatively low price, fish provides a delicious and nutritious source of protein that is rich in vitamins and minerals. Fish and shellfish can provide most of the nutrients that the body requires — and in generous amounts. The high-quality amino acids in fish are readily digested; and fish products are rich in B complex vitamins, such as thiamine, riboflavin, niacin, vitamin B_6, vitamin B_{12}, and pantothenic acid. Fish is also a good source of calcium, iron, potassium, phosphorus, copper, iodine, manganese, and cobalt, and it is low in sodium. Most fish species are also low in fat. Thus, fish offers the same high protein content as red meats, but it is lower in calories.

Seafood meals are also time and money savers. Preparation is simple with little waste, and no special equipment is required. Fish can be mixed with soups, chowders, and casseroles and goes well with almost any spice. It can also be baked, broiled, grilled, poached, steamed, or fried.

The rest of this activity will teach you —

- How to select and purchase fish
- How to store fish
- How to prepare fish in new ways
- How to enjoy a good seafood meal

Selecting and Purchasing Fish

Just what should you look for when buying fish? How much should you buy? Careful attention to the color, texture, and odor of fish can help you make the right decision. The charts on page 2 offer guidelines for buying seafood.

Buying and Storing Fish

Fish can be bought in the following forms:

- In the round — whole intact fish just as they come out of the water.
- Drawn — entrails and sometimes gills removed.
- Dressed — entrails and scales removed. The head, fins, and tail may or may not be removed.
- Fillets, chunks, and steaks. Fillets, with or without the skin on, are usually boneless portions removed from the sides of the fish. Chunks and steaks are made by cutting cross-sections of the fish; these contain segments of the backbone.

Careful storage of seafood is important to avoid deterioration and lost quality. Quality is lost in several ways:

Oxidation of the oil or fat in the fish flesh can cause the fish to become rancid.

Dehydration caused by improper packaging results in poor quality. Known as freezer burn in frozen fish.

Action of enzymes in the flesh causes deterioration. Low temperatures slow enzymatic action and conserve the original quality.

Growth of bacteria increases when sanitation in handling is poor and when storage temperature is too high.

Freezing

Fresh fish, either caught or purchased, can be frozen for later use.

Fish should not be frozen in-the-round because the intestinal contents may impart off-odors and off-flavors to the flesh. Digestive enzymes and bacteria found in the intestinal fluids can also begin to digest the fish flesh before the product freezes.

After cleaning, scaling, trimming, and washing, the fish can be wrapped in plastic freezer wrap or frozen and glazed. Glazing is the process of applying a thin ice film over the product. The product is frozen, then dipped in water and refrozen. This forms a film of ice over the fish. After glazing, it should be wrapped in a freezer bag. Fish can also be frozen in plastic containers or waxed cartons filled with water.

Thawing Frozen Seafoods

Proper thawing is just as important as proper freezing. They should be thawed as quickly as possible, but never in hot water or room temperature. Thawing under cold, running water is the fastest and best means of thawing. Seafoods can be cooked frozen, but extra cooking time is needed.

What to Look for When Buying Seafood to Insure Freshness*

Fish

Fresh Whole Fish

- Flesh: Firm, elastic, not separating from bone. (Will change color and look dried out with age.)
- Eyes: Clear, bright, transparent (no milky color). Eyes get cloudy with age.
- Gills: Bright red, free of slime. (Will change from red, to pink, to gray, and then brown or dark green as fish loses freshness.)
- Odor: Fresh and mild. Fish taken directly from water usually have no or only a mild odor. A strong fish odor usually indicates an old fish.
- Skin: Shiny. Color should be bright. Colors fade with age.

Fresh Fillets and Steaks

- Flesh: No traces of browning or drying out. Should be firm to the touch. If packaged, wrapping should be moisture and vapor proof with no or few air spaces.
- Odor: Fresh and mild.

Frozen Fish Products

- Flesh: Solidly frozen. Cut surfaces, if visible, should look glossy. No abnormally white or dark spots, papery edges, discoloration, or other signs of drying.
- Odor: Little or none.
- Wrapping: Moisture- and vapor-proof wrapping should fit tightly. No air spaces between fish and wrapping. Wrapping should be unopened and untorn.

Shellfish

Live

- Clams, oysters, mussels: Hard, tightly closed shells. If shell is open, tap shell. If shell closes, the animal is still alive. If the shells don't close, the animal is dead–a gapper — and should not be eaten.
- Lobsters and crabs: Should be heavy for size and show leg movement. Lobster's tail will curve under body and not hang down when lifted out of water.

Other than Live

- Shucked oysters: Plump, with mild color. Usually have a creamy color. Any liquid should be clear.
- Scallop meats: Sweetish odor, free of excess liquid when bought in a bag. Moist, white.

Fresh Shrimp

- Flesh: Firm, not soft or mushy.
- Odor: Mild.
- Color: Bacterial action causes increased reddening. Biochemical degradation and prolonged exposure to light cause the color to darken (black spots).

Cooked Shrimp

- Meat: Reddish tint.
- Shell: Red.
- Odor: No disagreeable odor.

Cooked Lobster and Crabs

- Color: Bright red.
- Odor: No disagreeable odor.

*provided by Dave Chase, Regional Extension Specialist — Sea Grant.

How Much Fish Should I Buy?

Fish and shellfish	*Approximate amount to purchase for 6 servings*
Fish, whole	4½ pounds
Fish, dressed or pan dressed	3 pounds
Fish, fillets or steaks	2 pounds
Fish, portions	2 pounds
Fish, sticks	1½ pounds
Fish, canned	1 pound
Clams, in the shell	3 dozen
Clams, shucked	1 quart
Crab, cooked meat	¾ to 2 pounds
Lobsters, live	4–6 pounds
Lobsters, cooked meat	¾–2 pounds
Oysters, in the shell	3 dozen
Oysters, shucked	1 quart
Scallops, shucked	¾–2 pounds
Shrimp, headless	1½–3 pounds
Shrimp, cooked meat	¾–1½ pounds

Cooking Fish

The most important thing to remember when using fish is not to overcook. Fish requires less cooking time than comparable weight meats. Fillets and steaks should be tested often with a fork while cooking to avoid overcooking. When it flakes, it is done. Frying is fastest (3–5 minutes for deep frying, 8–10 for pan frying). Poaching or steaming takes 5–10 minutes. Broil fish in an oven or over charcoal for 10–15 minutes. Bake fillets or steaks for 20–25 minutes at 350°. A whole, dressed fish requires the longest time — bake 45–60 minutes at 350°.

Simple nutritious snacks can be made from fish. Try the following recipe for a tasty treat for your group:

Tuna Cheesies

- 1 can (6½ or 7 oz.) tuna
- 1 cup shredded cheese
- ¼ cup butter or margarine, softened
- 2 tablespons lemon juice
- 1⅓ tablespoons grated onion
- 1 teaspoon Worcestershire sauce
- ½ teaspoon paprika
- 3 drops liquid hot pepper sauce
- 30 melba toast rounds

Drain and flake tuna. Cream the cheese and butter. Add seasonings and tuna. Mix thoroughly. Spread each toast round with approximately 2 teaspoons of tuna mixture. Place on a baking pan, 15 × 10 × 1 inch. Broil about 4 inches from source of heat for 3 to 5 minutes or until lightly browned. Makes approximately 30 canapes.

Fish can be prepared in many ways. A fish stock is both thrifty and easy to do. Use the following recipe for a warm pick-me-up:

Basic Fish Stock

- 1½ pounds fresh fish trimmings — heads tails, bones, etc. (heads should be split)
- 1 quart water
- ½ cup onions, coarsely chopped
- ¼ cup celery including leaves, coarsely chopped
- 1 bay leaf
- ½ teaspoon salt
- ¼ teaspoon thyme
- 5 black peppercorns or ¼ teaspoon pepper

Place fish in a 3- to 4-quart saucepan and add water. Bring slowly to a boil over moderate heat and cook 5 minutes. Add remaining ingredients and reduce heat to low. Partially cover and simmer for 30 minutes. Remove pan from heat and strain the stock into a deep bowl. Fresh stock will keep up to 3 days in a refrigerator or may be frozen for prolonged storage. Makes approximately 1 quart.

Fish can be enhanced in many creative ways. Try the following recipe once you have some experience with cooking fish:

Sourdough Fried Fish With Blueberry Sauce

Sourdough Starter

- 1 package active dry yeast
- 1 quart lukewarm water
- 2 tablespoons sugar
- 4 cups all-purpose flour

In a large crock or mixing bowl, soften yeast in water. Add sugar and flour; beat until ingredients are blended. Cover and let rise. Let stand at room temperature several days to develop slightly sour flavor; refrigerate. As starter is used, add equal amounts of flour and water to replace the amount used. The starter will need additions of flour and water about once a week if not used.

Sourdough Fried Fish

Step 1

- ½ cup sourdough starter
- 1 cup lukewarm water
- 1¼ cups all-purpose flour

Step 2

- ¼ cup milk or cream
- 1 egg, beaten
- 1 tablespoon sugar
- 1 tablespoon vegetable oil
- ½ teaspoon baking soda
- ½ teaspoon salt

Step 3

- 2 pounds lingcod fillets, or other thick fish fillets, fresh or frozen
- 1 teaspoon salt
- ¼ teaspoon pepper
- ½ cup flour
- Fat for frying
- Blueberry Sauce

Mix ingredients in step 1. Cover and let stand overnight; place fish, if frozen, in refrigerator to thaw. When ready to cook, stir ingredients in step 2 into refrigerated batter. Let stand and bubble 10 minutes. Cut fish into serving-size portions and sprinkle with salt and pepper; coat with flour. Dip fish in sourdough batter. Fry in large, deep skillet with fat approximately 2 inches deep, turning once until both sides are brown and fish flakes easily when tested with a fork. Drain on absorbent paper. Serve with hot blueberry sauce. Makes 6 servings.

Blueberry Sauce

- 2 cups blueberries
- ½ cup water
- ¼ to ⅓ cup sugar
- 2-inch stick cinnamon
- 2 tablespoons fresh lemon juice
- 1 teaspoon cornstarch
- 1 tablespoon water

Additional Notes for Leaders

This nutrition activity is designed to supplement nutrition projects through your local 4-H program. It is intended to illustrate that fish is an important protein source often neglected by many families.

The project is intended to be open ended. For ease in teaching, leaders can use the following guide:

Lesson 1. Fish and Nutrition. Some time should be spent illustrating fish as a member of the meat group. As a protein source, fish is an important, low-calorie meat substitute. It is also high in minerals and vitamins.

Lesson 2. Buying, Preparing, and Storing Fish. A trip to the local fish market can be used to complement a discussion on what to look for in buying quality fish. Once the fish is purchased, how is it to be used? Cleaning and properly storing the fish are important to ensure freshness.

Cleaning the Fish

For convenience and to save space, the fish to be frozen should be in a final-use form, such as pan dressed, filleted, or steak-cut.

Pan Dressing Fish

To pan dress fish, remove scales, entrails, head, tail and fins. The entire head structure is removed by cutting through the whole fish just behind the gill covers. Remove entire fin structures including "root bones" which extend internally from fin rays.

Filleting Fish

To fillet fish, cut the sides of the fish away from backbone. Remember to cut over the rib cage or remove severed rib bones from the flesh after the fillet is cut away.

Making Fish Steaks

Steaks are made by cutting the dressed fish cross-wise through the backbone. On larger fish, a small saw or a hammer strike with your fillet knife might be needed to cut through backbone.

Special Preparation Problems

Some larger carp and suckers have a distinctive band of red muscle below the skin along the length of each side of the fish. This muscle has a mealy texture and a strong flavor. Simply avoid this muscle when eating the fish; or, before cooking, cut along both sides to remove all the visible red meat. The red muscle will be thicker along the lateral line.

Some fish (such as pickerel and pike) have bones that make them hard to eat. These three easy preparation methods will help minimize this problem:

- *Scoring.* Cut ⅔ of the way through fillet at ¼-inch intervals along full length of the fish. This scoring breaks the bones into smaller pieces and allows cooking to soften the bones.
- *Flaking.* Place enough water in a pot to cover fish. Add two tablespoons of salt and vinegar. Bring water to boil and place fish in water. Reduce heat and simmer for about 12 minutes. Remove fish and chill. The fish will flake away from bones, and the meat can be used in fish recipes.
- *Grinding.* Cut filleted fish into strips. Run strips through a meat grinder using the finest blade. Fortify ground fish with oatmeal or breadcrumb binder, and shape into patties or loaves. Cook as you would hamburger meals.

Storing the Fish

Rapid freezing is important. Rapid freezing creates smaller ice crystals and does not rupture tissue. It also prevents enzyme action that spoils the fish. The freezer should be turned to its coldest setting. Small portions will freeze more rapidly. The setting can be returned to its normal setting once the product is frozen. Oxygen should be kept away from the fish as much as possible as polyunsaturated fats spoil more rapidly. Plastic freezer wrapping or glazing will help.

Freezing Shrimp

1. Shell the raw tails.
2. Wash, place in a container and freeze.
3. After frozen, fill containers with cold water and refreeze.
4. Shrimp should last 8 to 12 months.

Freezing Crabs

1. Deback and clean crab cores.
2. Boil cores and place in containers.
3. While cores are still wet, freeze quickly to glaze.
4. Fill containers with cold water and freeze.

Freezing Oysters

1. Shuck oysters.
2. Freeze in plastic containers (small).
3. Cover with water and refreeze.

Approximate Storage Life of Frozen Fish and Shellfish at 0°F.

Types	Examples	Maximum Time
Fat fish	Mackerel, salmon, tuna	3 months
Lean fish	Haddock, cod, carp, swordfish	6 months
Shell fish	Lobsters, crabs (meat)	2 months
	Shrimp	12 months
	Oysters, scallops, clams	3 to 4 months

Lesson 3. Cooking the Fish. The many species of fish can be cooked and enhanced in many ways. Several recipes have been divided into three groups according to difficulty in preparation. At the beginning level, the fish used are relatively easy to secure and the recipes simple. The intermediate group stresses variety in preparation. The advanced level adds special garnishes, spices, and herbs that accessorize an ordinary flavor. The range of tastes and aromas that can be provided is boundless. The right seasonings in the right amounts enhance the final effect.

The following spices may be tried, in judicious amounts:

Basil, sweet	Dill seed	Onion salt
Bay leaf	Dill weed	Oregano
Cayenne pepper	Fennel seed	Paprika
Celery salt	Garlic powder	Parsley
Celery seed	Garlic salt	Rosemary
Chervil	Marjoram	Saffron
Cinnamon	Mustard	Tarragon
Curry powder	Nutmeg	Thyme

Use condiments with seafood, such as catsup, mustard, Worcestershire sauce and pickle relish — but use them sparingly. A little will complement, but too much will overpower.

A delicious sauce can make a simple dish a memorable one. Accent basic seafood recipes with complementary sauces. Use sauces such as hollandaise, amadine, creole, cucumber, lemon, Spanish, and mushroom.

Fish Platter Accompaniments

Build "appetite appeal" as well as "eye appeal" into your meals. A tangy-sweet flavor enhances the delicate taste of seafood. Choose a contrasting flavor to accompany your fish entree.

- Broiled orange sections dipped in honey and shredded coconut.
- Broiled peach halves sprinkled with oregano-seasoned bread crumbs.
- Cherry tomatoes filled with seasoned cottage cheese.
- Golden broiled pineapple slices teamed with vivid spiced crab apples.
- Grape jelly in small pear halves.
- Heated tomato halves topped with drained warm sauerkraut and caraway seed.
- Orange cups filled with cranberry sauce or lemon-cranberry relish.
- Thin, unpeeled orange slices topped with tiny plain or sugared grape clusters. Add mint or water cress sprigs.
- Whole tomatoes filled with cole slaw. Cut tomatoes almost through into sixths and spread open to give a petal effect before adding cole slaw.

Recipes

The recipes can be done in any order according to the abilities of the group. You may also want to use some of your own ideas. Using different fish, vary the methods of preparation. Adding complementary garnishes can make fish products an exciting addition to the diet.

Additional help can be obtained from your nearest County or Sea Grant Extension office.

Additional Recipes for Beginning Cooks

Charcoal-Broiled Fish Portions or Sticks

12 frozen fried fish portions (2½ to 3 oz. each)
OR
24 frozen fried fish sticks (¾ to 1¼ oz. each)
Tartar sauce

Place frozen fish in a single layer in well-greased, hinged wire grills. Cook about 4 inches from moderately hot coals for 4 to 5 minutes. Turn. Cook 4 to 5 minutes longer or until fish are heated through and flake easily when tested with a fork. Serve with a tartar sauce. Makes 6 servings.

Fish, Italian Style

12 frozen fried fish portions (2½ to 3 ounces each)
1 can (8 ounces) spaghetti sauce with mushrooms
1 tsp. oregano
1 pkg. (4 oz.) shredded mozzarella cheese

Place frozen fish portions in a single layer on a baking pan, 15 × 10 inches. Combine sauce and oregano. Spoon sauce on each portion. Sprinkle with cheese. Bake in an extremely hot oven, 500°F., for 10 to 15 minutes or until fish is hot and cheese melts. Makes 6 servings.

Tuna Nuggets

2 cans (6½ or 7 oz. each) tuna
1 tablespoon lemon juice
2 teaspoons horseradish
2 pkgs. (3 oz. each) cream cheese, softened
¼ teaspoon liquid hot pepper sauce
1 cup chopped parsley

Drain and flake tuna. Cream the cheese. Add seasonings and tuna. Mix thoroughly. Portion tuna mixture with a tablespoon. Shape into small balls. Roll in parsley. Chill. Makes approximately 40 hors d'oeuvres.

Fried Fish Portions or Sticks

12 frozen fried or raw breaded fish portions (2½ to 3 ozs. each)
OR
24 frozen fried fish sticks (¾ to 1¼ oz. each)
Fat for frying
Tartar sauce

Place frozen fish in a single layer in hot fat in a 10-inch fry pan. Fry at a moderate heat for 4 to 5 minutes or until brown. Turn carefully. Fry 4 to 5 minutes longer or until fish are brown and flake easily when tested with a fork. Drain on absorbent paper. Serve with a tartar sauce. Makes 6 servings.

Additional Recipes for Intermediate Cooks

Tuna Barbecue

2 cans (6½ or 7 oz. each) tuna
½ cup chopped onion
2 tablespoons tuna oil
½ cup chopped celery
½ cup chopped green pepper
1 cup catsup
1 cup water
2 tablespoons brown sugar
2 tablespoons vinegar
2 tablespoons Worcestershire sauce
1 teaspoon prepared mustard
½ teaspoon salt
Dash pepper
6 hamburger rolls

Drain tuna, reserving oil. Break tuna into large pieces. In a large kettle over hot coals, cook onion in oil until tender. Add remaining ingredients except tuna and rolls. Simmer uncovered for 20 minutes, stirring frequently. Add tuna and simmer 10 minutes longer, stirring frequently. Split rolls and toast. Place approximately ½ cup tuna mixture on bottom half of roll. Cover with top half of roll. Serves 6.

Souper Clam Dandy

2 cans (7½ or 8 oz each) minced clams
1 package (10 oz.) frozen baby lima beans
1 cup boiling water
½ teaspoon savory salt
4 slices bacon
2 cans (10½ oz. each) condensed cream of chicken soup
1½ cups milk
1 tablespoon onion powder
Dash liquid hot pepper sauce

Drain clams. Place beans in boiling salted water in a 3-quart saucepan. Bring to the boiling point again. Cover and simmer for 10 to 15 minutes or until beans are tender. Fry bacon until crisp. Drain on absorbent paper. Crumble bacon. When beans are tender, stir in remaining ingredients except bacon. Cover and simmer until hot. Garnish soup with bacon. Makes 6 servings.

Oven-Fried Fish

3 pounds pan-dressed fish, fresh or frozen
½ cup milk
2 teaspoons salt
1½ cups cereal crumb or toasted dry bread crumbs
¼ cup melted fat or oil

Thaw frozen fish. Clean, wash, and dry fish. Combine milk and salt. Dip fish in milk and roll in crumbs. Place fish in a single layer on a well-greased baking pan, 15 × 10 × 1 inches. Pour fat over fish. Bake in an extremely hot oven, 500°F., for 15 to 20 minutes or until fish are brown and flake easily when tested with a fork. Makes 6 servings.

Baked Stuffed Fish

3 pounds pan-dressed fish, fresh or frozen
Bread stuffing
2 tablespoons melted fat or oil
2 tablespoon lemon juice
1½ teaspoons salt
½ teaspoon paprika
Dash pepper

Thaw frozen fish. Clean, wash, and dry fish. Place fish in a single layer on a well-greased baking pan, 15 × 10 × 1 inches. Stuff fish loosely. Combine remaining ingredients and mix well. Brush fish with sauce. Bake in a moderate oven, 350°F., for 25 or 30 minutes or until fish flake easily when tested with a fork. Makes 6 servings.

Additional Recipes for Advanced Cooks

Tuna Dinner Pie With Cheese Sauce

2 cans (6½ or 7 oz. each) tuna
½ cup chopped onion
2 tablespoons margarine or cooking oil
2 tablespoons flour
½ teaspoon salt
Dash of pepper
1½ cups undiluted evaporated milk
2 eggs, beaten
9-inch unbaked pastry shell
Cheese Sauce, (recipe follows)
Tomato slices, optional

Drain and flake tuna. Cook onion in saucepan in margarine or oil until tender, but not brown. Stir in flour, salt, and pepper. Add milk; cook, stirring constantly, until thickened. Pour mixture over eggs very slowly, beating constantly. Bake pastry shell in moderate oven, 375°F., about 5 minutes. Remove crust from oven and spread tuna over crust; pour egg mixture over tuna. Return pie to oven; bake about 25 to 30 minutes or until filling is set. Let stand about 10 minutes before cutting into wedges. Serve with Cheese Sauce. Garnish with thin tomato slices, if desired. Makes one 9-inch pie, 4 to 6 servings.

Cheese Sauce

1 can (10¾ oz.) condensed cheddar cheese soup
½ cup undiluted evaporated milk

Combine soup and milk in saucepan; heat, stirring until hot and smooth. Makes about 1¾ cups sauce.

Tipsy Dixie Mullet

2 pounds mullet fillets or other fish fillets, fresh or frozen
1 gallon water
1 cup salt
½ cup beer
½ cup prepared mustard
¼ cup sesame seeds, toasted
2 tablespoons chopped parsley
2 cloves garlic, minced
½ teaspoon Worcestershire sauce
¼ teaspoon liquid hot pepper sauce
¼ cup sesame seeds, toasted
Paprika

Thaw fish if frozen. Cut into serving-size portions. Combine water and salt and stir until dissolved. Pour brine over fish and marinate for 30 minutes in refrigerator. Remove fish from brine, rinse thoroughly, and dry. Combine beer, mustard, ¼ cup sesame seeds, parsley, garlic, Worcestershire sauce, and liquid hot pepper sauce. Dip fish in mustard mixture and sprinkle with remaining ¼ cup sesame seeds and paprika. Place on well-greased grill inside smoke oven. Cook in a very slow oven, 250°F., for 30 to 45 minutes or until fish flakes easily when tested with a fork. Serve with hushpuppies. Makes 6 servings.

Easy-do Baked Hushpuppies

1 cup cornmeal
1 cup all-purpose flour
1 tablespoon baking powder
1 teaspoon sugar
1 teaspoon salt
⅛ teaspoon cayenne pepper
¾ cup milk
2 eggs, beaten
½ cup chopped onion
¼ cup melted margarine or cooking oil

Sift dry ingredients together. Add remaining ingredients and stir only until well blended. Place approximately 1 tablespoon batter into well-greased small muffin tin wells. Place muffin pans on sheets of aluminum foil the size of the pan to prevent over-browning. Bake in a hot oven, 425°F., for 15 to 20 minutes or until done. Makes approximately 4 dozen hushpuppies.
NOTE: Use 1¼-inch diameter wells. May also be baked on electric or gas grills.

Hangtown Fry (omelet)

1 can (12 oz.) medium oysters, fresh or frozen
3 slices bacon, cut in 1-inch pieces
8 eggs
¼ cup water
½ teaspoon salt
Dash of pepper
½ cup dry bread or cracker crumbs
⅓ cup flour
¼ cup milk
2 tablespoons melted margarine or cooking oil
2 teaspoons minced parsley
Lemon wedges

Thaw oysters if frozen; drain. Fry bacon in 10-inch frypan until crisp. Drain on absorbent paper. Reserve bacon drippings. Combine eggs, water, salt, and pepper; beat slightly, set aside. Combine and mix crumbs and flour. Dip oysters in milk; roll in crumb mixture. Heat margarine and reserved bacon drippings in frypan. Fry oysters in hot fat over moderate heat for 2 to 3 minutes or until lightly browned. Sprinkle crisp bacon pieces over oysters. Pour egg mixture over bacon and oysters. Cook over low heat. Gently lift edge of omelet with spatula to allow uncooked egg to flow to bottom of pan. Cook just until eggs are set. Sprinkle with parsley before serving. If preferred, loosen omelet around edge of pan; fold and roll onto heated platter and sprinkle with parsley. Serve with lemon wedges. Makes 6 servings.

Seafood Creole

1 pound fresh fish fillets
¼ cup vegetable oil or melted fat
¼ cup flour
1 cup hot water
½ cup green onions including tops, chopped
¼ cup green pepper, chopped
½ cup parsley, chopped
4 cloves garlic, finely chopped
1½ teaspoons salt
Dash cayenne pepper
½ teaspoon thyme
2 whole bay leaves
1 lemon slice
1 can (8 ounces) tomato sauce
Cooked rice

Cut fillets into small cubes. Prepare a roux by heating oil in large skillet and blending in flour over medium heat, stirring constantly until brown. Add water gradually and cook until thick and smooth, stirring constantly. Add remaining ingredients except rice. Cover and simmer for 20 minutes. Remove bay leaves and serve over cooked rice. Makes 4 to 6 servings.

The author of this activity is H. David Greene, regional extension specialist, East Aurora, New York.

The author wishes to express thanks to Mr. David Chase, Sea Grant extension specialist, Riverhead; Mr. Jim Daniels, Sea Grant extension specialist, Ithaca; Mr. Michael Voiland, Sea Grant extension specialist, Brockport; Ms. Jean Butzer, extension associate, Genesee County; Ms. Jane Pease, extension associate, Chautauqua County; Ms. Sue Bauer, extension associate, Erie County; and Ms. Ann Verbeck, extension associate, Erie County, for their assistance in the preparation of this activity. Materials used were adapted from Sea Grant programs in Florida, California, Wisconsin, and New York and from materials provided by N.O.A.A. Information was also obtained from publications produced by the U.S. Department of the Interior, Bureau of Commercial Fisheries.

Recipes were obtained from the following publications:

A Seafood Heritage — From the Plains to the Pacific, U.S. Department of Commerce.

Fish and Shellfish Over the Coals, Test Kitchen Series 14, U.S. Department of Commerce.

Nautical Notions for Nibbling, U.S. Department of Commerce.

Seafood Retailing, Samuel M. Gillespie and William B. Schwartz, Texas Parks and Wildlife Department, Austin, TX. 1977.

The Great All-American Seafood Cookout, Florida Department of Natural Resources, Bureau of Marketing and Extension Service.

Time for Seafood, U.S. Department of Commerce.

For additional copies and information contact:

Youth Coastal Education Program
21 South Grove Street
East Aurora, New York 14052

Marine Education Program
111 Broadway, Suite 1700
New York, New York 10006

What is Sea Grant?

Sea Grant is a state and federal program concerned with the understanding, development, and wise use of our ocean's resources. The Sea Grant Extension Service is the link between researchers' and scholars' knowledge of the ocean and the practical application and use of such information. Sea Grant Extension Service has local offices on both of New York's coastlines. Extension specialists assist a variety of marine users and potential users, including commercial and recreational fishermen, elementary and secondary school teachers, shorefront community leaders, and officials. For more information about Sea Grant marine education programs and how you can participate, contact:

Linda O'Dierno
Ruth Folit
New York Sea Grant
111 Broadway, 17th Floor
New York, NY 10006
212-587-9722

David Greene
Youth Education
21 South Grove Street
East Aurora, NY 14052
716-652-5453

The State University of New York and Cornell University cooperatively carry out the Sea Grant Program using their own funds as well as State and Federal appropriations. Nearly two-thirds of the dollars come through the National Sea Grant office of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Price per copy 35 cents.

Cooperative Extension, the New York State College of Human Ecology, and the New York State College of Agriculture and Life Sciences, at Cornell University, Ithaca, N.Y., and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8, June 30, 1914, and providing equal opportunities in employment and programs. Lucinda A. Noble, Director. 6/80 CP 1M 6408